의학박사 학위논문

한국에 거주하는 아시아 이주민과 내국인 간 심혈관질환 위험요인의 비교

A comparison of cardiovascular risk factors among Asian migrants and the native population in Korea

2020년 8월

서울대학교 대학원

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Abstract

A comparison of cardiovascular risk factors among Asian migrants and the native population in Korea

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Migration presents a substantial social and public health issue. This study investigated the nationwide population, including 2,680,495 adults aged 20 years and older (987,214 Asian migrants and 1,693,281 Koreans), who received health check-ups, using the Korean National Health Information Database (2009-2015). With regard to the age-adjusted prevalence of lifestyle factors, socioeconomic status, and health status among Chinese, Japanese, Filipino, Vietnamese, and other Asian migrants, compared with

Koreans, direct age standardisation was conducted separately by sex using 10-year age bands, in which the world standard population was used as the standard population. In 2015, among participants aged 20 years and older, the age-adjusted prevalence of obesity in Chinese migrant women (25.6%) was higher than that in Korean women (23.2%) (P < 0.0001). The age-adjusted prevalence of obesity in Filipino migrant women (30.9%) was higher than that in Korean women (23.2%) (P = 0.0023). The age-adjusted prevalence of obesity in other Asian migrant women (35.5%) was higher than that in Korean women (23.2%) (P < 0.0001). In addition, among participants aged 20-49 years, the age-adjusted prevalence of diabetes in Filipino migrant women (2.6%) was higher than that in Korean women (1.8%) (P = 0.0090). The age-adjusted prevalence of hypertension in Filipino migrant women (7.7%) was higher than that in Korean women (4.2%) (P < 0.0001). In the multivariate analyses, compared with Koreans, the odds ratios of developing type 2 diabetes and hypertension were 0.82 (95% CI, 0.78 to 0.86) and 0.77 (95% CI, 0.75 to 0.79) among Asian migrants between 2009-2015, respectively. However, the odds ratio of developing type 2 diabetes was 1.32 (95% CI, 1.11 to 1.57) among Vietnamese migrant men aged 20-39 years compared with Korean men. Compared with Korean women, the odds ratios of developing hypertension were 1.49 (95% CI, 1.05 to 2.11) and 2.22 (95% CI, 1.17 to 4.19) among Filipino migrant women aged 20-39 years and more than 40 years,

respectively. Joinpoint regression was used to estimate the annual percentage change (APC) of cardiovascular risk factors. In the Joinpoint regression, the age-adjusted prevalence was calculated separately by sex using direct age standardisation, while the age groups consisted of those 20–44, 45–64, and ≥ 65 years; and the Korean mid-year population in 2005 was used as the standard population. Increasing prevalence trends of obesity were shown among Asian migrant men (from 27.9% in 2009 to 28.9% in 2013, APC = 0.89, $P < 0.05$; from 28.9% in 2013 to 31.7% in 2015, APC = 4.70, $P < 0.05$) compared with Korean men; increasing prevalence trends of obesity were shown among Asian migrant women (from 22.5% in 2009 to 25.2% in 2015, APC = 1.92, $P < 0.05$), compared with Korean women. Moreover, the age-adjusted prevalence of obesity (41.4%) in Filipino migrant men was higher than that (30.4%) in men from the general population in the Philippines in 2015. Furthermore, in 2014, the age-adjusted prevalence of diabetes (12.5%) among Filipino migrant men was higher than that (7.1%) in men from the general population in the Philippines. The results could help establish a new strategy for prevention, treatment, and management of obesity, diabetes, and hypertension among Asian migrants and the native population in Korea.

Key words: Obesity, diabetes, hypertension, Filipino migrant,

Vietnamese migrant, National Health Information Database

Student Number: 2013-31353

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1 Introduction

1.1 International migration in the world, including Asia and Korea

Recently, increasing international migration has become a very important social and public issue. It has been estimated that among 258 million international migrants, 106 million are Asian-born; 60% of international migrants are in Asia and Europe, comprising 80 million and 78 million, respectively (1). Furthermore, as estimated by the International Labour Organization, there are 164 million international migrant workers (2). However, the living and working conditions for the majority of international migrant workers are poor, especially when they move from low-income and middle-income countries to high-income countries (3). The labour environment is likely to harm their health, especially those migrants with low-income level (3). Therefore, improving the healthcare and welfare system for international migrants is necessary.

According to a report published in 2015, 1.9 million international immigrants stay in the Republic of Korea, accounting for 3.7% of the total population (4). Moreover, 50.3% of international immigrants in Korea were from China and included Korean-Chinese. Apart from international migrants

from China, those from countries such as the United States (7.3%), Vietnam (7.2%), Thailand (4.9%), the Philippines (2.9%), and Japan (2.5%) were also reported (4). Furthermore, migrant workers account for the majority of international migrants in Korea (4). Therefore, meeting the medical care and treatment needs of these migrants, especially targeting low-income migrant workers, will further improve global health equity in Korea.

1.2 Health of international migrants throughout the world

1.2.1 The continuous efforts to improve migrant health

Since the 1950s, multilateral organisations and countries around the world have made various efforts to promote the health of migrants (3)(Figure 1). However, there is still a long way to go. Political, cultural, environmental, and structural irrationality in the host countries may have a significantly adverse impact on migrant health, especially in low-income and other marginalised groups. Besides, most migrant health studies lack high-quality data to support migration-related questions. Furthermore, studies on migrant health using the ideal longitudinal data collection method are limited (3, 5).

Figure 1. Selective various efforts to promote the health of migrants in the multilateral organizations and countries around the world since 1950s*

Abbreviations: IOM, International Organization for Migration; OCHA, UN Nations Office for the Coordination of Humanitarian Affairs; UNGAHLD, UN General Assembly High-level Dialogue on International Migration and Development; WHA, World Health Assembly.

*Reprinted from Abubakar, I., Aldridge, R. W., Devakumar, D., Orcutt, M., Burns, R., Barreto, M. L., Dhaval, P., Fouad, F. M.,

1.2.2 The health of international migrants, compared with the general population in the host country

According to a recent systematic review and meta-analysis on migration health, the mortality rate of international migrants who were studying, working, or who had joined family members in high-income countries was lower than that of the general population in the host countries. Possible exceptions could be mortality due to infectious diseases like viral hepatitis, tuberculosis, and HIV as well as external causes such as assault and events of undetermined intent (6) (Figure 2 and Figure 3).

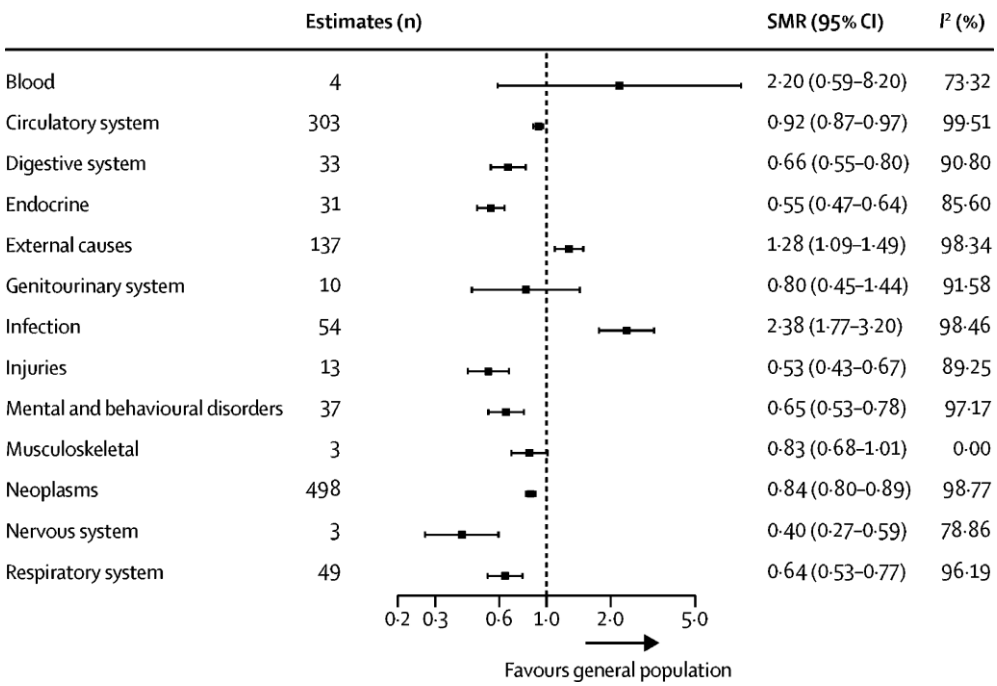


Figure 2. Meta-analysis estimates of SMRs for international migrants by ICD-10 disease category*

Abbreviations: SMR=Standardised mortality ratio. ICD-10=International Classification of Diseases, Tenth revision.

*Reprinted from Aldridge, R. W., Nellums, L. B., Bartlett, S., Barr, A. L., Patel, P., Burns, R., Hargreaves, S., Miranda, J. J., Tollman, S., Friedland, J. S. and Abubakar I., Global patterns of mortality in international migrants: a systematic review and meta-analysis, *Lancet*, Volume 392, pp. 2553-2566, Copyright (2018) by Elsevier.

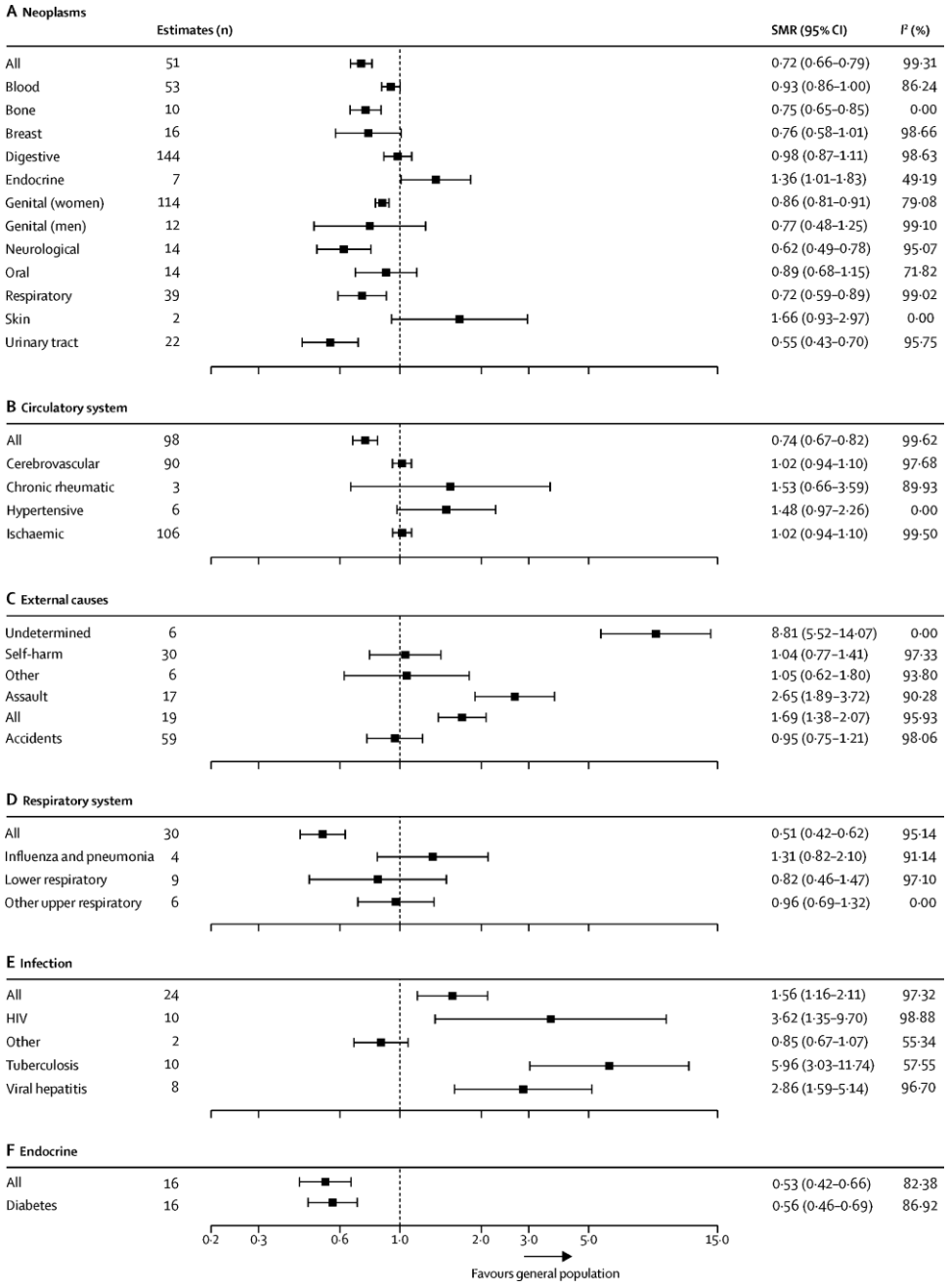


Figure 3. Subgroup analysis of international migrants by ICD-10 subgroup disease category for the six ICD-10 disease categories with the highest total number of SMR estimates*

Data are presented for neoplasms (A), the circulatory system (B), external

causes (C), respiratory diseases (D), infection (E), and endocrine disorders (F). Abbreviations: SMR=Standardised mortality ratio. ICD-10=International Classification of Diseases, Tenth revision.

*Reprinted from Aldridge, R. W., Nellums, L. B., Bartlett, S., Barr, A. L., Patel, P., Burns, R., Hargreaves, S., Miranda, J. J., Tollman, S., Friedland, J. S. and Abubakar I., Global patterns of mortality in international migrants: a systematic review and meta-analysis, *Lancet*, Volume 392, pp. 2553-2566, Copyright (2018) by Elsevier.

1.2.3 Healthy migrant hypothesis

Recent systematic reviews and meta-analyses of migrant health have supported the healthy migrant hypothesis, which describes a health advantage among international migrants (6, 7). This health advantage, also known as the healthy migrant effect, suggests that international migrants, particularly recent migrants, are healthier than the general population of the host country (7-9). The self-selection or immigration policy can explain the healthy migrant effect (8-11). However, the healthy migrant effect gradually disappears with an increasing duration of residence in the host country (5, 7, 12).

1.3 Studies on migrant health

1.3.1 Migrant health and cardiovascular risk factors

Compared with the general population in the host country, international migrants are often relatively healthy in the initial years of migration; however, as they stay longer in the host country, their health status tends to deteriorate (5). Moreover, an expert review targeting migrant health in Europe, North America, and Australia has shown that cardiovascular disease varies with the country of origin and destination and duration of residence among international migrants (13). In addition, the duration of residence is related to the increasing prevalence of cardiovascular risk factors, such as obesity, diabetes, and hypertension among international migrants in the United States (14). However, whether a health advantage exists with regard to cardiovascular risk factors among Asian migrants in Korea is unclear. Moreover, it is unknown how the development of type 2 diabetes (T2D) and hypertension changes according to nationality.

1.3.2 The worldwide trends in diabetes and hypertension

Overweight and obesity are a global challenge, and raised body mass index (BMI) can result in cardiovascular diseases and diabetes (15). In addition, diabetes is increasing throughout the

world, including Asia and Korea, and the prevention, treatment, and management of diabetes is needed to reduce the global burden (16–18). The management of adults with T2D by lifestyle modification, social support, and medication adherence is important to reduce the risk of cardiovascular problems and other complications (19, 20). Moreover, the prevalence of hypertension is decreasing in high–income countries while increasing in low–income and middle–income countries (21). However, to date, among international migrants and the general population in the destination country, especially in Asia, the change in the status of diabetes and hypertension over time and the determinants of T2D and hypertension have not been reported.

1.3.3 Limitations of previous studies on migration health

First, the age–adjusted prevalence of cardiovascular risk factors estimates among Asian migrants and the native population, according to nationality, are lacking in Korea.

Second, few studies have examined the determinants of incident T2D and hypertension between Asian migrants and the native population by nationality in Korea.

Third, there is little analysis of prevalence in obesity, diabetes, and hypertension among international migrants, compared with

the general population in the home countries in Asia.

Finally, there was limited migrant research among the nationwide population, based on high-quality data using the ideal longitudinal data collection method.

1.4 The purpose of this study

First, the current study aimed to investigate the prevalence of cardiovascular risk factors among Asian migrants in Korea compared with Koreans, according to nationality. Second, we aimed to examine the differences between Asian migrants and Koreans in terms of the development of T2D and hypertension among the nationwide population. Third, we aimed to analyse the annual prevalence trends of cardiovascular risk factors among Asian migrants and the native population in Korea from 2009 to 2015. Finally, we aimed to examine the differences in the prevalence of obesity, diabetes, and a raised blood pressure among Chinese, Filipino, and Vietnamese migrants compared with the general population of their home country.

2 Methods

2.1 Study design and data collection

We conducted a population-based case analysis of Asian migrants and the general population aged ≥ 20 years who received health check-ups during 2009-2015 using the National Health Information Database (NHID) established by the Korean National Health Insurance Service (NHIS) (22, 23). The NHID included the eligibility, National Health check-up, healthcare utilisation, long-term care insurance, and health care provider information (23). In addition, the NHID is suitable for population-based studies and can be applied to primary and secondary prevention of chronic diseases such as diabetes and hypertension (23-26). The health check-up database of Asian migrants was obtained from customised NHID data, which represent the majority of Asian migrants who received health check-ups in Korea (22, 23). Moreover, the health check-up database of the native population was obtained from the 1 million sample cohort of the NHID, which was a random sample of 2.2% of the Korean-born population, to represent the nationwide population in Korea (22, 27). Of 2,691,010 participants who met the abovementioned criteria, 350 without information on blood pressure, fasting blood glucose, and total cholesterol were

excluded. Furthermore, 10,165 with missing information on smoking status, alcohol use, and physical activity were also excluded. Finally, the study population included 2,680,495 participants, including 987,214 Asian migrants and 1,693,281 Koreans (22). From 2009 to 2015, the number of Asian migrants by year was 93,845, 113,414, 129,827, 132,226, 142,275, 175,082, and 200,545, respectively; the number of Koreans by year was 208,772, 231,881, 236,751, 244,443, 243,592, 261,680, and 266,162, respectively (22). After excluding participants with diabetes and hypertension at the first health check-up (2009-2015), the number of participants who underwent health check-ups more than once with information on the presence or absence of diabetes and hypertension at the last health check-up was 505,342 and 431,433, respectively. The number of participants newly diagnosed with T2D and hypertension between the first and last health check-up was 22,284 and 48,007, respectively.

Although almost I performed nearly all the analysis, based on the opinions of Professor Jae Moon Yun at the Department of Family Medicine, Seoul National University Hospital, the data was constructed in order to conduct multivariable logistic regression analysis between Asian migrants and Koreans in incident T2D and hypertension. During the data processing

procedure, Professor Jae Moon Yun helped me review the whole code and statistical analysis. The Institutional Review Board of Seoul National University Hospital approved the study on November 20, 2015 (IRB number: 1511-061-079).

In the current study, Asian migrants were from China, Japan, Vietnam, the Philippines, Indonesia, Thailand, Uzbekistan, Sri Lanka, Mongolia, Bangladesh, Pakistan, and India. Asian migrants were divided into Chinese, Japanese, Filipino, Vietnamese, and other Asian migrants to ensure sufficient samples after age standardisation in 2015. In addition, for the accuracy of age standardisation, migrants from Thailand, Uzbekistan, Sri Lanka, Mongolia, Bangladesh, Pakistan, Indonesia, and India were grouped into 'other Asian migrants' when the data were derived from the NHID. For example, there were not enough samples for several positive indicators of cardiovascular risk factors among Indonesian migrants aged ≥ 60 years. Therefore, migrants from Thailand, Uzbekistan, Sri Lanka, Mongolia, Bangladesh, Pakistan, Indonesia, and India were combined and defined as 'other Asian migrants' collectively as age standardisation resulted in insufficient data on specific positive outcome indicators.

Age, sex, and monthly insurance premiums were included in the data collected by the NHIS, and the insurance premium was

determined by income levels in Korea (22, 26). In our study, monthly insurance premiums were used to indicate economic status, and economic status (first, second, third, and fourth quartiles) was also regarded as a vital statistic that represented income level (low, middle-low, high-middle, and high, respectively). The health check-up participation data were obtained from the NHID health check-up database. According to the information in the health questionnaires, participants were categorised as non-smoker, ex-smoker, or current smoker; as any alcohol use ≥ 1 time/week (yes), or < 1 time/week (no); and as physical activity ≥ 3 times/week (yes), or > 3 times/week (no). Physical inactivity was defined as physical activity < 3 times/week. Measurements of weight, height, and blood pressure were included in the physical exams, and BMI was calculated as weight (kg) divided by height (m^2); obesity was defined as a BMI ≥ 25 kg/m^2. Raised blood pressure was defined as a blood pressure ≥ 140/90 mm Hg. Hypertension was defined as a blood pressure ≥ 140/90 mm Hg, record of a diagnosis of hypertension, or prescription of antihypertensive drugs in the health questionnaires. Furthermore, total cholesterol and fasting blood glucose were included in the laboratory tests, and hypercholesterolemia was defined as a total cholesterol ≥ 240 mg/dL. Raised fasting blood glucose was defined as a fasting blood glucose ≥ 126 mg/dL. Diabetes was defined as a fasting

blood glucose ≥ 126 mg/dL, previous diabetes diagnosis, or prescription of antidiabetic drugs in the health questionnaires.

2.2 Independent variable and dependent variables

The main independent variable in this study was the nationality of Asian migrants and the native population in Korea. In addition, Asian migrants were divided into Chinese, Japanese, Filipino, Vietnamese, and other Asian migrants.

The primary dependent variables were the prevalence of cardiovascular risk factors such as obesity, diabetes, and hypertension (28, 29). The secondary dependent variables were the incidence of T2D and hypertension. We excluded participants with diabetes and hypertension at the first health check-up to ascertain incident T2D and hypertension. Incident T2D and hypertension were determined for each participant between the first and last health check-up.

2.3 Statistical analysis

2.3.1 A brief overall of research design and statistical analysis

Here, in order to review the steps of designing and analyzing data clearly, a brief overall of research design and statistical analysis is given in Figure 4.

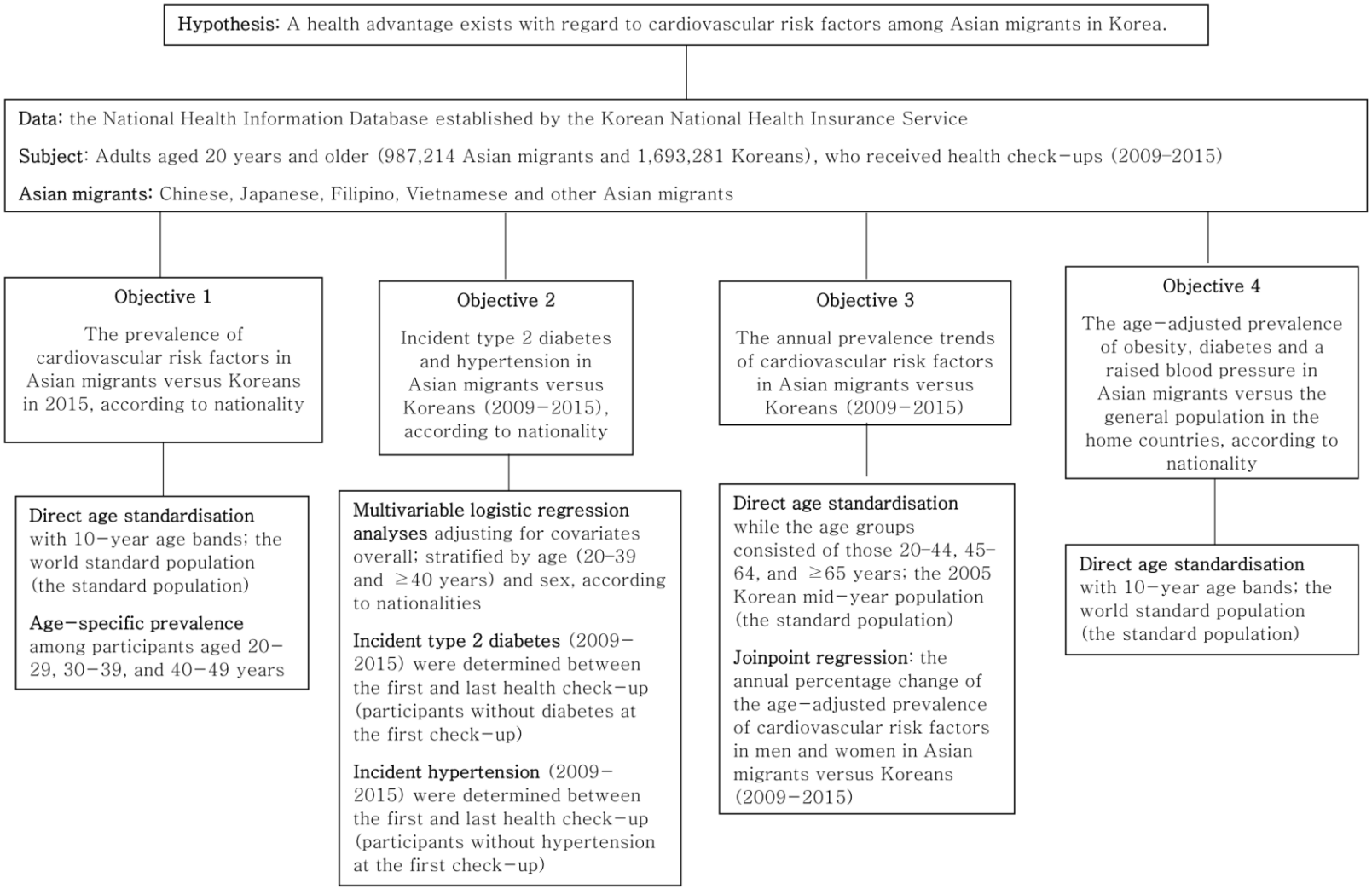

Hypothesis: A health advantage exists with regard to cardiovascular risk factors among Asian migrants in Korea.
Data: the National Health Information Database established by the Korean National Health Insurance Service
Subject: Adults aged 20 years and older (987,214 Asian migrants and 1,693,281 Koreans), who received health check-ups (2009-2015)
Asian migrants: Chinese, Japanese, Filipino, Vietnamese and other Asian migrants
Objective 1
The prevalence of cardiovascular risk factors in Asian migrants versus Koreans in 2015, according to nationality
Direct age standardisation with 10-year age bands; the world standard population (the standard population)
Age-specific prevalence among participants aged 20-29, 30-39, and 40-49 years
Objective 2
Incident type 2 diabetes and hypertension in Asian migrants versus Koreans (2009-2015), according to nationality
Multivariable logistic regression analyses adjusting for covariates overall; stratified by age (20-39 and ≥40 years) and sex, according to nationalities
Incident type 2 diabetes (2009-2015) were determined between the first and last health check-up (participants without diabetes at the first check-up)
Incident hypertension (2009-2015) were determined between the first and last health check-up (participants without hypertension at the first check-up)
Objective 3
The annual prevalence trends of cardiovascular risk factors in Asian migrants versus Koreans (2009-2015)
Direct age standardisation while the age groups consisted of those 20-44, 45-64, and ≥65 years; the 2005 Korean mid-year population (the standard population)
Joinpoint regression: the annual percentage change of the age-adjusted prevalence of cardiovascular risk factors in men and women in Asian migrants versus Koreans (2009-2015)
Objective 4
The age-adjusted prevalence of obesity, diabetes and a raised blood pressure in Asian migrants versus the general population in the home countries, according to nationality
Direct age standardisation with 10-year age bands; the world standard population (the standard population)

Figure 4. A brief overall of the steps for research design and statistical analysis

Overall, we hypothesised that Asian migrants are healthier than Koreans and also explored the association between the nationality of the Asian migrants and cardiovascular risk factors in Korea.

2.3.2 A comparison of prevalence of cardiovascular risk factors between Asian migrants and the native population in 2015

First, this study aimed to investigate the prevalence of cardiovascular risk factor estimates among Asian migrants and the native population, based on nationality. With regard to objective 1, the independent variable in this study was the nationality of the Asian migrants and the native population in Korea, which was divided into Chinese, Japanese, Filipino, Vietnamese, Korean, and other Asians. In addition, the main dependent variables were the prevalence of cardiovascular risk factors, including current smokers, physical inactivity, obesity, diabetes, hypertension, and hypercholesterolemia (28, 29). Here, our hypothesis is that the prevalence of cardiovascular risk factors among Asian migrants in Korea is lower than that among Koreans. Specifically, for objective 1, our hypotheses are divided into several parts as follows:

(a1) The prevalence of current smokers among Asian migrants in Korea is lower than that among Koreans, even when stratified by nationality.

The null hypothesis is that the prevalence of current smokers among Asian migrants is higher than or equal to that of Koreans, even when stratified by nationality.

(a2) The prevalence of physical inactivity among Asian migrants in Korea is lower than that among Koreans, even when stratified by nationality.

The null hypothesis is that the prevalence of physical inactivity among Asian migrants is higher than or equal to that of Koreans, even when stratified by nationality.

(a3) The prevalence of obesity among Asian migrants in Korea is lower than that among Koreans, even when stratified by nationality.

The null hypothesis is that the prevalence of obesity among Asian migrants is higher than or equal to that among Koreans, even when stratified by nationality.

(a4) The prevalence of diabetes among Asian migrants in Korea is lower than that among Koreans, even when stratified by nationality.

The null hypothesis is that the prevalence of diabetes among Asian migrants is higher than or equal to that among Koreans, even when stratified by nationality.

(a5) The prevalence of hypertension among Asian migrants in Korea is lower than that among Koreans, even when stratified by nationality.

The null hypothesis is that the prevalence of hypertension among Asian migrants is higher than or equal to that among Koreans, even when stratified by nationality.

(a6) The prevalence of hypercholesterolemia among Asian migrants in Korea is lower than that among Koreans, even when stratified by nationality.

The null hypothesis is that the prevalence of hypercholesterolemia among Asian migrants is higher than or equal to that among Koreans, even when stratified by nationality.

With regard to the first set of analysis, the age-adjusted prevalence of lifestyle factors, socioeconomic status, and health status among Asian migrants and the native population, according to nationality, were calculated. The age-adjusted prevalence was calculated separately by sex using direct age standardisation. Prevalence was defined as the number of participants with cases,

in a given year, per number of participants in the population who underwent a health check-up during this period. With regard to the age-adjusted prevalence of lifestyle factors, socioeconomic status, and health status among Chinese, Japanese, Filipino, Vietnamese, and other Asian migrants, compared with Koreans, age standardisation was conducted using 10-year age bands, in which the world standard population was used as the standard population (30). However, we selected a study population aged ≥ 30 years for age standardisation in diabetes because there were not enough samples among Japanese migrants aged 20–29 years, compared with those of Koreans. We selected a study population aged 20–59 years for age standardisation in current smokers because there were not enough samples among Filipino and Vietnamese migrants aged ≥ 60 years. In addition, we calculated the age-specific and age-adjusted prevalence of lifestyle factors, socioeconomic status, and health status among Chinese, Filipino, Vietnamese, and other Asian migrants, compared with Koreans separately by sex. To this end, we used direct age standardisation in migrants aged 20–29, 30–39, and 40–49 years, in which the world standard population was used as the standard population (30). With regard to direct age standardisation between 20-49 years, Japanese migrants were excluded due to insufficient data for Japanese migrants aged 20–29 years. For these analyses, we also examined the prevalence

rate ratios and 95% log−normal confidence intervals (31).

2.3.3 Incident type 2 diabetes and hypertension between Asian migrants and the native population

Second, we aimed to analyse the differences between Asian migrants and Koreans with respect to the incidence of T2D and hypertension nationwide, using longitudinal data. With regard to objective 2, the independent variable in this study was the nationality of the Asian migrants and the native population in Korea, which was divided into Chinese, Japanese, Filipino, Vietnamese, Korean, and other Asians. In addition, the dependent variables were incident T2D and hypertension. Here, our hypothesis is that the incidence of T2D and hypertension among Asian migrants in Korea is less than that among Koreans. Specifically, for objective 2, our hypotheses are divided into several parts as follows:

(b1) The incidence of T2D among Asian migrants in Korea is less than that among Koreans, according to the nationality of the Asian migrants.

The null hypothesis is that incident T2D among Asian migrants is higher than or equal to that among Koreans, according to the nationality of the Asian migrants.

(b2) The incidence of hypertension among Asian migrants in

Korea is less than that among Koreans, according to the nationality of the Asian migrants.

The null hypothesis is that incident hypertension among Asian migrants is higher than or equal to that among Koreans, according to the nationality of the Asian migrants.

With regard to the second set of analysis, to examine the differences in the development of T2D and hypertension between Asian migrants and the native population according to nationality, multivariable logistic regression analyses were conducted and adjusted for the following covariates: age (continuous, years), sex, economic status, BMI (continuous, kg/m^2), smoking status, alcohol use, and physical activity. For these analyses, adjusted odds ratios (aORs) and 95% confidence intervals (CIs) of incident T2D and hypertension determinants were examined between the first and last health check-ups. In addition, we conducted multivariable logistic regression analyses stratified by age (20-39 and ≥ 40 years) and sex.

2.3.4 Time series analysis through Joinpoint regression

Third, we aimed to analyze the annual prevalence trends of cardiovascular risk factors among Asian migrants and Koreans in Korea from 2009 to 2015. With regard to objective 3, the independent variable in this study was the nationality of Asian

migrants and the native population in Korea, which was divided into Asian migrant and Korean. In addition, the main dependent variables were the prevalence of cardiovascular risk factors, including diabetes, hypertension, hypercholesterolemia, and obesity (28, 29). Here, our hypothesis is that the prevalence of cardiovascular risk factors among Asian migrants in Korea is increasing compared with Koreans from 2009 to 2015. Specifically, for objective 3, our hypotheses are divided into several parts as follows:

(c1) The prevalence of diabetes among Asian migrants in Korea is increasing compared with Koreans from 2009 to 2015.

The null hypothesis is that the prevalence of diabetes among Asian migrants in Korea is decreasing or stable compared with Koreans from 2009 to 2015.

(c2) The prevalence of hypertension among Asian migrants in Korea is increasing compared with Koreans from 2009 to 2015.

The null hypothesis is that the prevalence of hypertension among Asian migrants in Korea is decreasing or stable compared with Koreans from 2009 to 2015.

(c3) The prevalence of hypercholesterolemia among Asian migrants in Korea is increasing compared with Koreans from 2009 to 2015.

The null hypothesis is that the prevalence of hypercholesterolemia among Asian migrants in Korea is decreasing or stable compared with Koreans from 2009 to 2015.

(c4) Our hypothesis is that the prevalence of obesity among Asian migrants in Korea is increasing compared with Koreans from 2009 to 2015.

The null hypothesis is that the prevalence of obesity among Asian migrants in Korea is decreasing or stable compared with Koreans from 2009 to 2015.

With regard to the third set of analysis, we conducted Joinpoint regression in order to estimate the annual percentage change (APC) of the age-adjusted prevalence of cardiovascular risk factors in men and women among Asian migrants and the native population from 2009 to 2015 in Korea. Additionally, we estimated the APC of the age-adjusted prevalence of lifestyle factors and economic status. The age-adjusted prevalence was calculated separately by sex using direct age standardisation, while the age groups consisted of those 20–44, 45–64, and ≥ 65 years. Prevalence was defined as the number of participants with cases that existed in a given year/number of participants in the population who received a health check-up during this period. The Korean mid-year population in 2005 was used as the

standard population.

2.3.5 Health of Asian migrants in Korea, compared with the general population in the home countries

Finally, we aimed to analyse the differences in the prevalence of obesity, raised blood pressure, and diabetes among Chinese, Japanese, Filipino, and Vietnamese migrants in Korea, compared with the general population in their home countries; data were obtained from the Global Health Observatory data repository of the World Health Organization. With regard to objective 4, the independent variable in this study was the nationality of the Asian migrants and the general population in their home countries, which was divided into Chinese, Japanese, Filipino, and Vietnamese. In addition, the dependent variables were the prevalence of cardiovascular risk factors, including obesity, diabetes, and raised blood pressure (28, 29). Here, our hypothesis is that the prevalence of cardiovascular risk factors among Asian migrants in Korea is lower than that among the general population in their home countries. Specifically, for objective 4, our hypotheses are divided into several parts as follows:

(d1) The prevalence of obesity among Asian migrants in Korea is lower than that among the general population in their home countries.

The null hypothesis is that the prevalence of obesity among Asian migrants in Korea is higher than or equal to that among the general population in their home countries.

(d2) The prevalence of diabetes among Asian migrants in Korea is lower than that among the general population in their home countries.

The null hypothesis is that the prevalence of diabetes among Asian migrants in Korea is higher than or equal to that among the general population in their home countries.

(d3) The prevalence of raised blood pressure among Asian migrants in Korea is lower than that among the general population in their home countries.

The null hypothesis is that the prevalence of raised blood pressure among Asian migrants in Korea is higher than or equal to that among the general population in their home countries.

With regard to the final set of analysis, we examined differences in the age-adjusted prevalence of obesity, raised blood pressure, and diabetes among Chinese, Filipino, and Vietnamese migrants, compared with the general population in their home countries. Age standardisation was conducted using 10-year age bands, and the world standard population was used as the standard population (30). However, the age-adjusted

prevalence of obesity, raised blood pressure, and diabetes in Japanese migrants was calculated separately by sex, while the age groups consisted of those 20–44, 45–64, and ≥ 65 years to ensure enough samples in the population. Health data among the general population in China, Japan, the Philippines, and Vietnam were obtained from the Global Health Observatory data repository of the World Health Organization. Data are available from http://apps.who.int/gho/data/node.main.A867?lang=en/.

All analyses were performed using the Joinpoint Regression Program version 4.6.0 (National Cancer Institute, Rockville, MD, USA), R software version 3.6.3 (R Foundation for Statistical Computing, Boston, MA, USA), and SAS version 9.3 (SAS Institute Inc., Cary, NC, USA), and a P value < 0.05 was considered statistically significant.

3 Results

3.1. Study population

This study investigated the nationwide population of Korea (2,680,495 adults). From 2009 to 2015, a total of 987,214 Asian migrants aged ≥ 20 years who received health check-ups were identified in Korea. In addition, 1,693,281 Koreans aged ≥ 20 years who received health check-ups from the national 1 million sample cohort were also identified. The characteristics of Asian migrants and Koreans based on the 1-year moving averages are shown in Table 1 and Table 2.

Table 1. Characteristics of Asian migrants aged 20 years and older who received health check-ups, from 2009 to 2015*

Variable	Year						
	2009	2010	2011	2012	2013	2014	2015
Asian migrant, n	93,845	113,414	129,827	132,226	142,275	175,082	200,545
Age (years, %)							
20-44	88.0	85.5	81.6	75.1	72.4	71.4	66.2
45-64	11.5	13.9	17.8	23.8	26.4	26.9	31.4
≥ 65	0.5	0.6	0.6	1.1	1.2	1.7	2.4
Sex (%)							
Men	80.5	78.7	76.7	72.4	71.3	70.8	68.3
Women	19.5	21.3	23.3	27.6	28.7	29.2	31.7
Economic status (%)							
1st quartile (low)	54.4	52.4	40.8	34.1	32.3	27.2	26.0
2nd quartile	38.9	39.9	48.2	50.0	50.3	52.2	49.7
3rd quartile	4.6	5.4	8.6	13.1	14.5	17.6	21.1
4th quartile (high)	2.1	2.3	2.4	2.8	2.9	3.0	3.2
Body mass index (kg/m^2)	22.9 ± 3.0	23.0 ± 3.0	23.1 ± 3.1	23.1 ± 3.1	23.1 ± 3.1	23.3 ± 3.2	23.4 ± 3.2
Smoking status (%)							
Ex-smoker	4.6	4.9	5.3	5.7	6.0	6.5	7.6
Current smoker	32.8	32.6	32.1	31.3	31.0	29.9	27.6
Any alcohol use (%)	43.9	45.0	44.7	43.0	43.0	43.1	42.6
Physical activity (%)	36.9	38.8	40.4	41.7	42.9	46.4	49.6
Obesity (%)	22.3	23.5	24.6	25.2	25.6	27.5	28.9
Hypertension (%)	9.7	9.4	10.0	11.1	11.3	11.7	12.8
Diabetes (%)	3.1	3.3	3.5	4.0	4.1	4.4	4.7
Hypercholesterolemia (%)	7.9	8.4	8.3	8.2	8.2	8.4	8.8

*Data are expressed as the means ± SD, or %.

Table 2. Characteristics of the native population aged 20 years and older who received health check-ups, from 2009 to 2015*

Variable	Year						
	2009	2010	2011	2012	2013	2014	2015
Korean, n	208,772	231,881	236,751	244,443	243,592	261,680	266,162
Age (years, %)							
20-44	44.7	43.8	43.6	42.0	42.1	40.5	39.2
45-64	42.0	43.2	43.3	44.4	43.6	45.0	45.9
≥ 65	13.3	13.0	13.1	13.6	14.3	14.5	14.9
Sex							
Men	54.5	54.3	54.1	53.9	53.8	53.6	53.1
Women	45.5	45.7	45.9	46.1	46.2	46.4	46.9
Economic status (%)							
1st quartile (low)	15.0	14.0	15.8	13.7	15.2	14.0	15.5
2nd quartile	26.7	25.4	26.5	24.6	25.4	25.5	25.0
3rd quartile	21.6	21.7	21.3	21.6	21.7	21.1	21.3
4th quartile (high)	36.7	38.9	36.4	40.1	37.7	39.4	38.2
Body mass index (kg/m^2)	23.7 ± 3.2	23.7 ± 7.3	23.8 ± 3.3	23.8 ± 3.3	23.8 ± 3.3	23.8 ± 3.4	24.0 ± 3.4
Smoking status (%)							
Ex-smoker	14.6	15.5	15.6	15.9	15.9	16.6	18.0
Current smoker	26.0	24.9	25.1	24.2	24.4	23.3	21.5
Any alcohol use (%)	49.1	48.9	49.3	48.9	49.6	49.9	50.1
Physical activity (%)	62.0	63.8	65.0	66.0	67.4	69.1	70.2
Obesity (%)	32.9	33.0	33.4	33.4	33.9	34.1	35.6
Hypertension (%)	24.4	24.6	25.1	25.5	25.4	25.4	25.4
Diabetes (%)	8.9	8.9	9.1	9.4	9.8	10.1	10.4
Hypercholesterolemia (%)	11.2	11.0	10.9	11.2	11.4	11.2	11.8

*Data are expressed as the means ± SD, or %.

Moreover, the characteristics of Asian migrants and the native population according to nationality in 2015 are shown in Table 3.

Table 3. Characteristics of Asian migrants and the native population aged 20 years and older who received health check-ups, according to nationality in 2015*

Variable	Native	Migrant				
	Korean	Chinese	Japanese	Filipino	Vietnamese	Other Asian
N	266,162	101,223	4,445	11,888	19,224	63,765
Age (years)	49.4 ± 14.0	46.4 ± 11.4	47.4 ± 9.2	32.5 ± 6.0	30.3 ± 9.2	30.3 ± 6.3
Sex (%)						
Men	53.1	52.8	28.7	80.3	70.9	92.7
Women	46.9	47.2	71.3	19.7	29.1	7.3
Economic status (%)						
1st quartile (low)	15.5	23.4	24.5	34.9	27.4	28.0
2nd quartile	25.0	45.1	19.2	53.2	53.1	57.5
3rd quartile	21.3	27.9	25.3	10.6	18.0	12.9
4th quartile (high)	38.2	3.6	31.0	1.3	1.5	1.6
Body mass index (kg/m^2)	24.0 ± 3.4	23.7 ± 3.3	23.2 ± 3.6	24.1 ± 3.1	21.8 ± 2.4	23.3 ± 3.2
Systolic blood pressure (mm Hg)	122.1 ± 14.5	121.6 ± 14.8	117.6 ± 14.3	121.2 ± 12.8	115.7 ± 12.0	118.8 ± 12.0
Fasting serum glucose (mg/dl)	99.8 ± 24.2	97.7 ± 21.9	95.4 ± 19.1	94.5 ± 18.6	90.3 ± 14.9	91.4 ± 16.8
Total serum cholesterol (mg/dl)	195.3 ± 38.9	190.4 ± 38.0	205.4 ± 38.2	192.0 ± 37.6	182.8 ± 37.5	185.0 ± 37.5
Smoking status (%)						
Ex-smoker	18.0	10.7	10.6	4.2	4.1	4.1
Current smoker	21.5	28.7	9.5	19.8	20.1	30.9
Any alcohol use (%)	50.1	46.2	30.5	46.4	39.9	37.9
Physical activity (%)	70.2	51.6	64.4	49.9	49.1	45.4

*Data are expressed as the means ± SD, or %.

3.2 Age-adjusted prevalence of lifestyle factors, socioeconomic situation and health status estimates among Asian migrants and the native population, according to nationality in 2015

The age-adjusted prevalence of lifestyle factors, socioeconomic situation and health status estimates among Asian migrants and the native population, according to nationality in 2015 are shown below.

In 2015, the age-adjusted prevalence of current smokers was higher in Chinese migrant men (52.8%) than that in Korean men (39.9%) (P < 0.0001). In addition, the age-adjusted prevalence of obesity in Chinese migrant women (25.6%) was higher than that in Korean women (23.2%) (P < 0.0001) (Table 4).

Table 4. Age-adjusted prevalence of lifestyle factors, socioeconomic situation, and health status estimates among Chinese migrants, compared with the native population aged 20 years and older who received health check-ups, in 2015

Variable	Age-adjusted prevalence (95% CI)*		*P* value
	Korean	Chinese migrant	
Men, n	141,312	53,415	
Current smoker	39.9 (39.5-40.3)	52.8 (52.1-53.6)	< 0.0001
Any alcohol use	70.3 (69.8-70.9)	68.6 (67.8-69.4)	0.0004
Physical inactivity	24.8 (24.5-25.1)	45.8 (45.1-46.4)	< 0.0001
Low income level	10.9 (10.7-11.1)	19.6 (19.2-20.1)	< 0.0001
Obesity	41.7 (41.3-42.1)	35.6 (35.0-36.2)	< 0.0001
Hypertension	22.4 (22.2-22.7)	20.4 (20.0-20.8)	< 0.0001
Diabetes	9.6 (9.5-9.8)	7.4 (7.2-7.7)	< 0.0001
Hypercholesterolemia	10.2 (10.0-10.4)	7.6 (7.4-7.9)	< 0.0001
Women, n	124,850	47,808	
Current smoker	3.8 (3.7-4.0)	2.9 (2.7-3.1)	< 0.0001
Any alcohol use	37.7 (37.3-38.2)	23.4 (22.8-24.0)	< 0.0001

Physical inactivity	32.0 (31.6–32.3)	46.5 (45.8–47.3)	< 0.0001
Low income level	19.2 (19.0–19.5)	29.6 (29.0–30.2)	< 0.0001
Obesity	23.2 (22.9–23.4)	25.6 (25.1–26.1)	< 0.0001
Hypertension	16.0 (15.8–16.2)	14.6 (14.2–14.9)	< 0.0001
Diabetes	5.9 (5.8–6.0)	4.4 (4.2–4.6)	< 0.0001
Hypercholesterolemia	9.5 (9.3–9.7)	8.3 (8.1–8.6)	< 0.0001

* Data are expressed as %; age standardisation with 10–year age bands; the world standard population was used as the standard population.

In 2015, the age–adjusted prevalence of hypercholesterolemia was higher in Japanese migrant men (14.4%) than that in Korean men (10.2%) (P = 0.0004). In addition, the age–adjusted prevalence of hypercholesterolemia in Japanese migrant women (13.8%) was higher than that in Korean women (9.5%) (P < 0.0001) (Table 5).

Table 5. Age–adjusted prevalence of lifestyle factors, socioeconomic situation, and health status estimates among Japanese migrants, compared with the native population aged 20 years and older who received health check–ups, in 2015

Variable	Age–adjusted prevalence (95% CI)*		*P* value
	Korean	Japanese migrant	
Men, n	141,312	1,274	
Current smoker	39.9 (39.5–40.3)	26.8 (22.1–31.5)	< 0.0001
Any alcohol use	70.3 (69.8–70.9)	70.4 (63.3–77.5)	0.9896
Physical inactivity	24.8 (24.5–25.1)	27.8 (23.4–32.3)	0.1608
Low income level	10.9 (10.7–11.1)	10.4 (6.7–14.0)	0.7779
Obesity	41.7 (41.3–42.1)	37.9 (32.5–43.3)	0.1869
Hypertension	22.4 (22.2–22.7)	18.3 (15.7–20.9)	0.0055
Diabetes †	12.3 (12.1–12.5)	8.0 (6.3–9.7)	< 0.0001
Hypercholesterolemia	10.2 (10.0–10.4)	14.4 (11.6–17.1)	0.0004
Women, n	124,850	3,171	
Current smoker	3.8 (3.7–4.0)	4.7 (3.2–6.2)	0.2068
Any alcohol use	37.7 (37.3–38.2)	28.9 (24.6–33.3)	0.0006
Physical inactivity	32.0 (31.6–32.3)	34.5 (31.1–37.9)	0.1397
Low income level	19.2 (19.0–19.5)	22.8 (20.4–25.2)	0.0018
Obesity	23.2 (22.9–23.4)	18.3 (16.0–20.6)	0.0002
Hypertension	16.0 (15.8–16.2)	13.2 (11.2–15.2)	0.0124
Diabetes †	7.6 (7.5–7.8)	5.6 (4.0–7.2)	0.0404
Hypercholesterolemia	9.5 (9.3–9.7)	13.8 (12.0–15.7)	< 0.0001

* Data are expressed as %; age standardisation with 10–year age bands; the world standard population was used as the standard population.
† Aged 30 years and older.

In 2015, the age–adjusted prevalence of obesity in Filipino

migrant women (30.9%) was higher than that in Korean women (23.2%) (P = 0.0023) (Table 6).

Table 6. Age-adjusted prevalence of lifestyle factors, socioeconomic situation, and health status estimates among Filipino migrants, compared with the native population aged 20 years and older who received health check-ups, in 2015

Variable	Age-adjusted prevalence (95% CI)*		*P* value
	Korean	Filipino migrant	
Men	141,312	9,541	
Current smoker†	44.2 (43.7-44.7)	23.0 (20.0-26.0)	< 0.0001
Any alcohol use	70.3 (69.8-70.9)	49.6 (40.1-59.1)	0.0004
Physical inactivity	24.8 (24.5-25.1)	52.9 (49.4-56.5)	< 0.0001
Low income level	10.9 (10.7-11.1)	28.6 (20.9-36.2)	< 0.0001
Obesity	41.7 (41.3-42.1)	41.4 (31.9-51.0)	0.9575
Hypertension	22.4 (22.2-22.7)	20.8 (10.3-31.3)	0.7717
Diabetes	9.6 (9.5-9.8)	8.9 (3.2-14.5)	0.8043
Hypercholesterolemia	10.2 (10.0-10.4)	11.2 (5.9-16.5)	0.6949
Women	124,850	2,347	
Current smoker†	4.4 (4.2-4.5)	2.0 (1.3-2.7)	< 0.0001
Any alcohol use	37.7 (37.3-38.2)	11.9 (8.8-15.0)	< 0.0001
Physical inactivity	32.0 (31.6-32.3)	51.6 (44.9-58.4)	< 0.0001
Low income level	19.2 (19.0-19.5)	42.0 (36.9-47.0)	< 0.0001
Obesity	23.2 (22.9-23.4)	30.9 (25.2-36.6)	0.0023
Hypertension	16.0 (15.8-16.2)	19.1 (13.2-24.9)	0.2658
Diabetes	5.9 (5.8-6.0)	5.2 (2.2-8.2)	0.6717
Hypercholesterolemia	9.5 (9.3-9.7)	11.2 (6.9-15.6)	0.3983

* Data are expressed as %; age standardisation with 10-year age bands; the world standard population was used as the standard population.

† Aged 20-59 years.

In 2015, the age-adjusted prevalence of hypercholesterolemia was higher in Vietnamese migrant men (12.9%) than that in Korean men (10.2%) (P = 0.0161). In addition, the age-adjusted prevalence of hypercholesterolemia in Vietnamese migrant women (12.9%) was higher than that in Korean women (9.5%) (P = 0.0008) (Table 7).

Table 7. Age-adjusted prevalence of lifestyle factors, socioeconomic situation, and health status estimates among Vietnamese migrants, compared with the native population aged 20 years and older who received health check-ups, in

2015

Variable	Age-adjusted prevalence (95% CI)*		*P* value
	Korean	Vietnamese migrant	
Men, n	141,312	13,624	
Current smoker†	44.2 (43.7-44.7)	33.2 (30.8-35.5)	< 0.0001
Any alcohol use	70.3 (69.8-70.9)	51.0 (47.0-54.9)	< 0.0001
Physical inactivity	24.8 (24.5-25.1)	51.5 (47.1-55.9)	< 0.0001
Low income level	10.9 (10.7-11.1)	21.7 (18.8-24.7)	< 0.0001
Obesity	41.7 (41.3-42.1)	13.5 (11.3-15.6)	< 0.0001
Hypertension	22.4 (22.2-22.7)	9.2 (6.7-11.6)	< 0.0001
Diabetes	9.6 (9.5-9.8)	3.4 (2.1-4.8)	< 0.0001
Hypercholesterolemia	10.2 (10.0-10.4)	12.9 (10.4-15.4)	0.0161
Women, n	124,850	5,600	
Current smoker†	4.4 (4.2-4.5)	2.2 (1.1-3.2)	0.0043
Any alcohol use	37.7 (37.3-38.2)	5.0 (4.2-5.7)	< 0.0001
Physical inactivity	32.0 (31.6-32.3)	56.4 (52.9-59.8)	< 0.0001
Low income level	19.2 (19.0-19.5)	38.5 (35.9-41.1)	< 0.0001
Obesity	23.2 (22.9-23.4)	12.7 (10.8-14.6)	< 0.0001
Hypertension	16.0 (15.8-16.2)	10.7 (8.4-13.0)	0.0003
Diabetes	5.9 (5.8-6.0)	5.6 (3.9-7.3)	0.7644
Hypercholesterolemia	9.5 (9.3-9.7)	12.9 (10.6-15.2)	0.0008

* Data are expressed as %; age standardisation with 10-year age bands; the world standard population was used as the standard population.

† Aged 20-59 years.

In 2015, the age-adjusted prevalence of current smokers was higher in other Asian migrant women (6.4%) than that in Korean women (3.8%) (P < 0.0001). In addition, the age-adjusted prevalence of obesity in other Asian migrant women (35.5%) was higher than that in Korean women (23.2%) (P < 0.0001) (Table 8).

Table 8. Age-adjusted prevalence of lifestyle factors, socioeconomic situation, and health status estimates among other Asian migrants, compared with the native population aged 20 years and older who received health check-ups, in 2015

Variable	Age-adjusted prevalence (95% CI)*		*P* value
	Korean	Other Asian migrant	
Men, n	141,312	59,117	
Current smoker	39.9 (39.5-40.3)	35.8 (31.6-39.2)	0.0264
Any alcohol use	70.3 (69.8-70.9)	45.4 (41.4-49.4)	< 0.0001

Physical inactivity	24.8 (24.5–25.1)	52.9 (49.4–56.5)	< 0.0001
Low income level	10.9 (10.7–11.1)	24.0 (21.7–26.3)	< 0.0001
Obesity	41.7 (41.3–42.1)	38.3 (34.6–42.1)	0.0917
Hypertension	22.4 (22.2–22.7)	18.4 (14.9–22.0)	0.0462
Diabetes	9.6 (9.5–9.8)	5.1 (3.8–6.5)	< 0.0001
Hypercholesterolemia	10.2 (10.0–10.4)	9.9 (8.4–11.4)	0.7087
Women, n	124,850	4,648	
Current smoker	3.8 (3.7–4.0)	6.4 (4.8–7.9)	< 0.0001
Any alcohol use	37.7 (37.3–38.2)	12.8 (11.1–14.5)	< 0.0001
Physical inactivity	32.0 (31.6–32.3)	53.2 (49.4–57.1)	< 0.0001
Low income level	19.2 (19.0–19.5)	36.3 (33.3–39.3)	< 0.0001
Obesity	23.2 (22.9–23.4)	35.5 (31.4–39.5)	< 0.0001
Hypertension	16.0 (15.8–16.2)	16.1 (12.7–19.6)	0.9494
Diabetes	5.9 (5.8–6.0)	6.0 (3.8–8.1)	0.9612
Hypercholesterolemia	9.5 (9.3–9.7)	11.4 (9.0–13.9)	0.0935

* Data are expressed as %; age standardisation with 10-year age bands; the world standard population was used as the standard population.

3.3 Prevalence of lifestyle factors, socioeconomic situation, and health status estimates among Chinese migrants, compared with the native population aged 20–49 years who received health check–ups, in 2015

In 2015, the adjusted–prevalence of lifestyle factors, socioeconomic situation, and health status estimates among Chinese migrants, compared with the native population aged 20–49 years who received health check–ups are shown in Table 9.

Table 9. Age–adjusted prevalence of lifestyle factors, socioeconomic situation, and health status estimates among Chinese migrants, compared with the native population aged 20–49 years who received health check–ups, in 2015

Variable	Age–adjusted prevalence (95% CI)*		*P* value
	Korean	Chinese migrant	
Men, n	77,038	32,194	
Current smoker	46.5 (45.9–47.1)	59.1 (58.1–60.1)	< 0.0001
Any alcohol use	76.0 (75.3–76.8)	70.5 (69.5–71.5)	< 0.0001
Physical inactivity	23.0 (22.6–23.4)	45.7 (44.9–46.5)	< 0.0001
Low income level	8.8 (8.5–9.1)	18.7 (18.1–19.2)	< 0.0001
Obesity	43.1 (42.5–43.6)	35.9 (35.2–36.6)	< 0.0001
Hypertension	12.2 (11.9–12.4)	11.2 (10.8–11.6)	< 0.0001
Diabetes	4.3 (4.2–4.5)	4.4 (4.2–4.6)	0.5731
Hypercholesterolemia	10.3 (10.1–10.6)	6.9 (6.6–7.2)	< 0.0001
Women, n	59,074	25,966	
Current smoker	4.8 (4.5–5.0)	3.9 (3.6–4.2)	< 0.0001
Any alcohol use	49.0 (48.3–49.6)	31.1 (30.3–32.0)	< 0.0001
Physical inactivity	30.2 (29.7–30.7)	45.9 (44.9–46.9)	< 0.0001
Low income level	17.9 (17.5–18.3)	30.5 (29.6–31.3)	< 0.0001
Obesity	16.9 (16.5–17.2)	20.3 (19.7–20.9)	< 0.0001
Hypertension	4.2 (4.1–4.4)	4.5 (4.3–4.7)	0.0684
Diabetes	1.8 (1.7–1.9)	1.7 (1.5–1.8)	0.3227
Hypercholesterolemia	5.7 (5.5–5.9)	4.3 (4.1–4.6)	< 0.0001

* Data are expressed as %; age standardisation with 10–year age bands; the

world standard population was used as the standard population.

With regard to age-specific prevalence, among participants aged 20-29 years, the prevalence of current smokers in Chinese migrant men (60.7%) was higher than that in Korean men (46.5%). Among participants aged 30-39 years, the prevalence of current smokers in Chinese migrant men (61.6%) was higher than that in Korean men (47.6%). Among participants aged 40-49 years, the prevalence of current smokers in Chinese migrant men (54.2%) was higher than Korean men (45.1%). In addition, among participants aged 30-39 years, the prevalence of diabetes in Chinese migrant men (4.1%) was higher than that in Korean men (3.5%). Moreover, among participants aged 30-39 years, the prevalence of obesity in Chinese migrant women (22.3%) was higher than that in Korean women (16.6%). Among participants aged 40-49 years, the prevalence of obesity in Chinese migrant women (27.5%) was higher than that in Korean women (23.5%). Furthermore, among participants aged 40-49 years, the prevalence of hypertension in Chinese migrant women (10.7%) was higher than that in Korean women (9.7%) (Figure 5, Figure 6, and Figure 8).

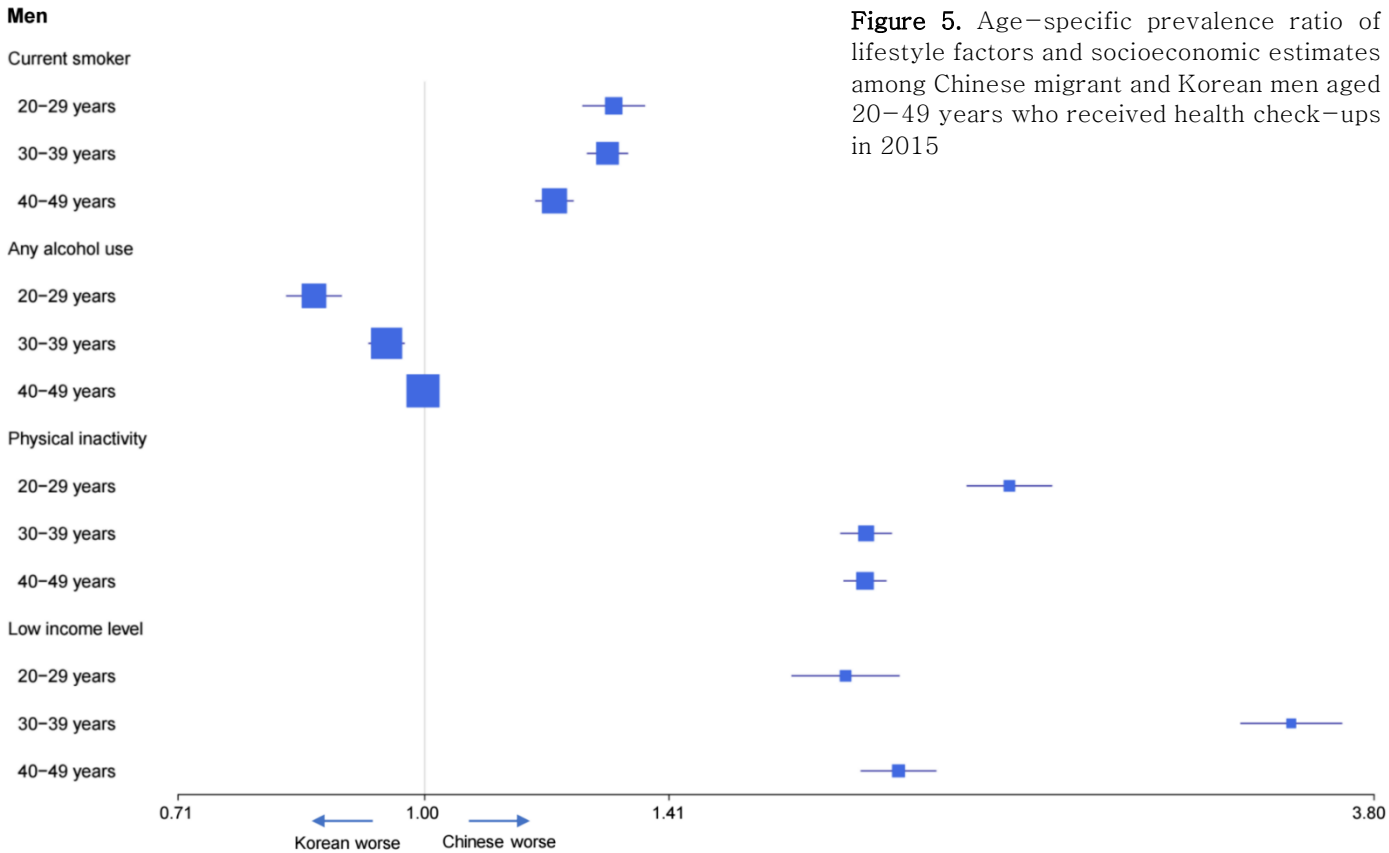


Figure 5. Age-specific prevalence ratio of lifestyle factors and socioeconomic estimates among Chinese migrant and Korean men aged 20–49 years who received health check-ups in 2015

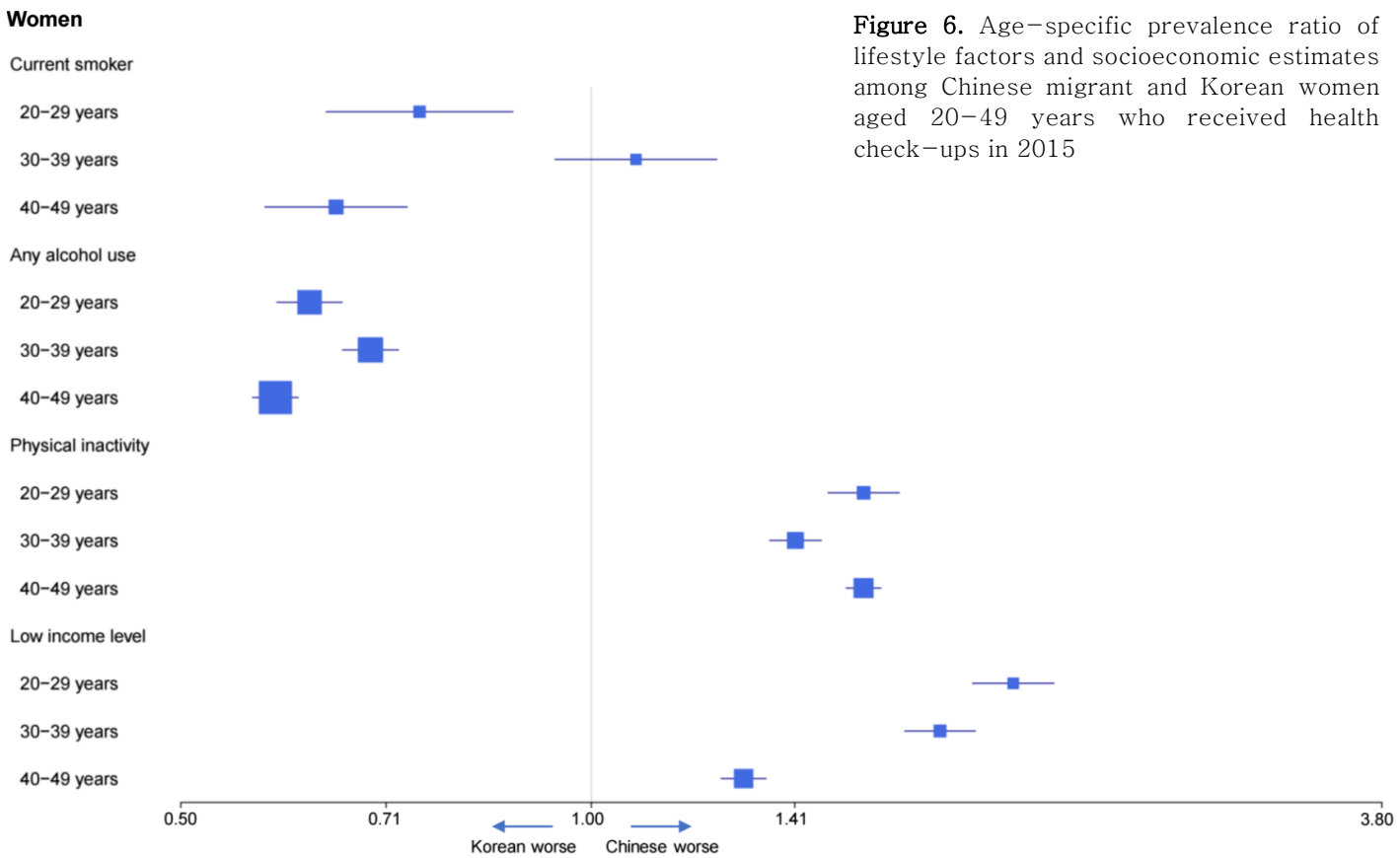


Figure 6. Age-specific prevalence ratio of lifestyle factors and socioeconomic estimates among Chinese migrant and Korean women aged 20–49 years who received health check-ups in 2015

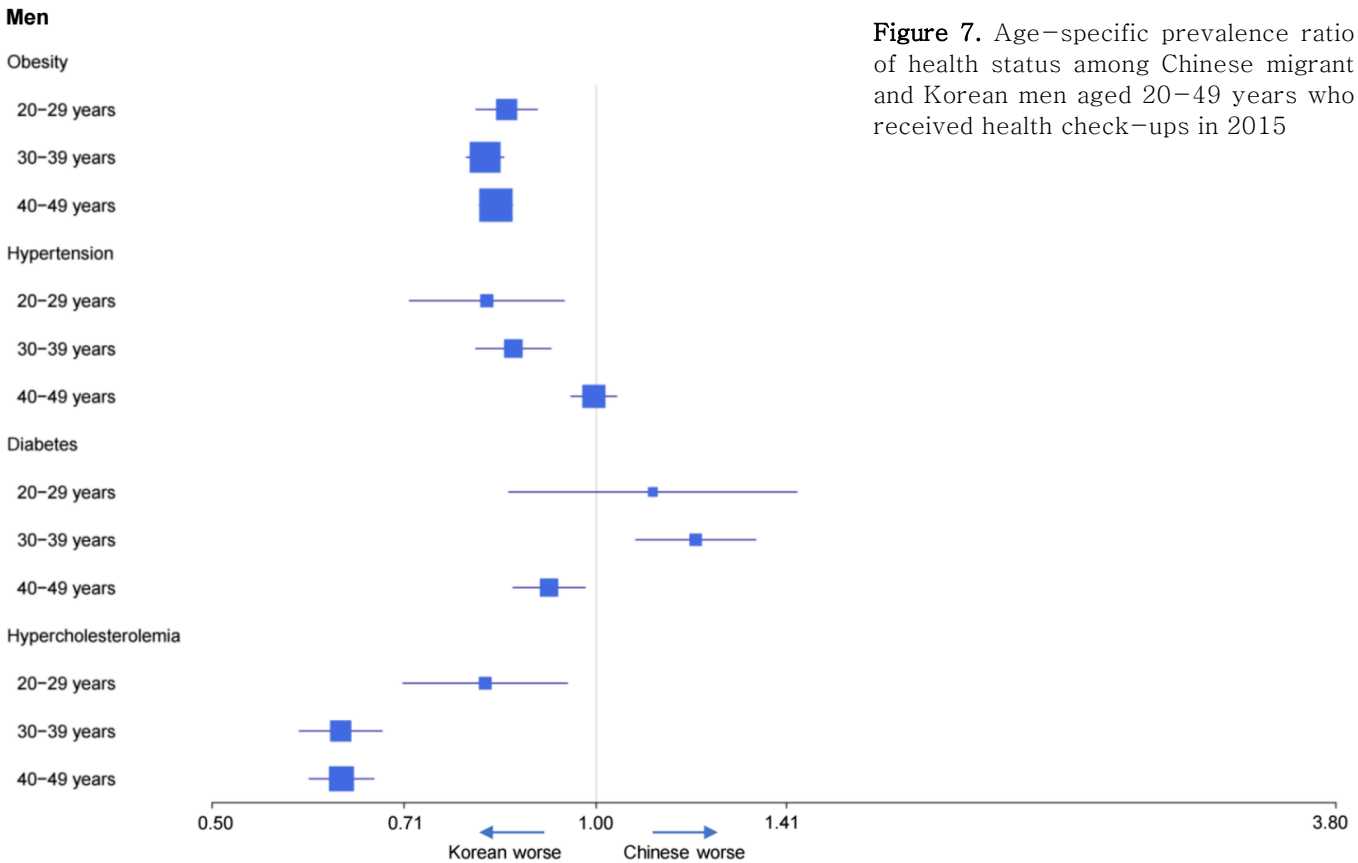


Figure 7. Age-specific prevalence ratio of health status among Chinese migrant and Korean men aged 20-49 years who received health check-ups in 2015

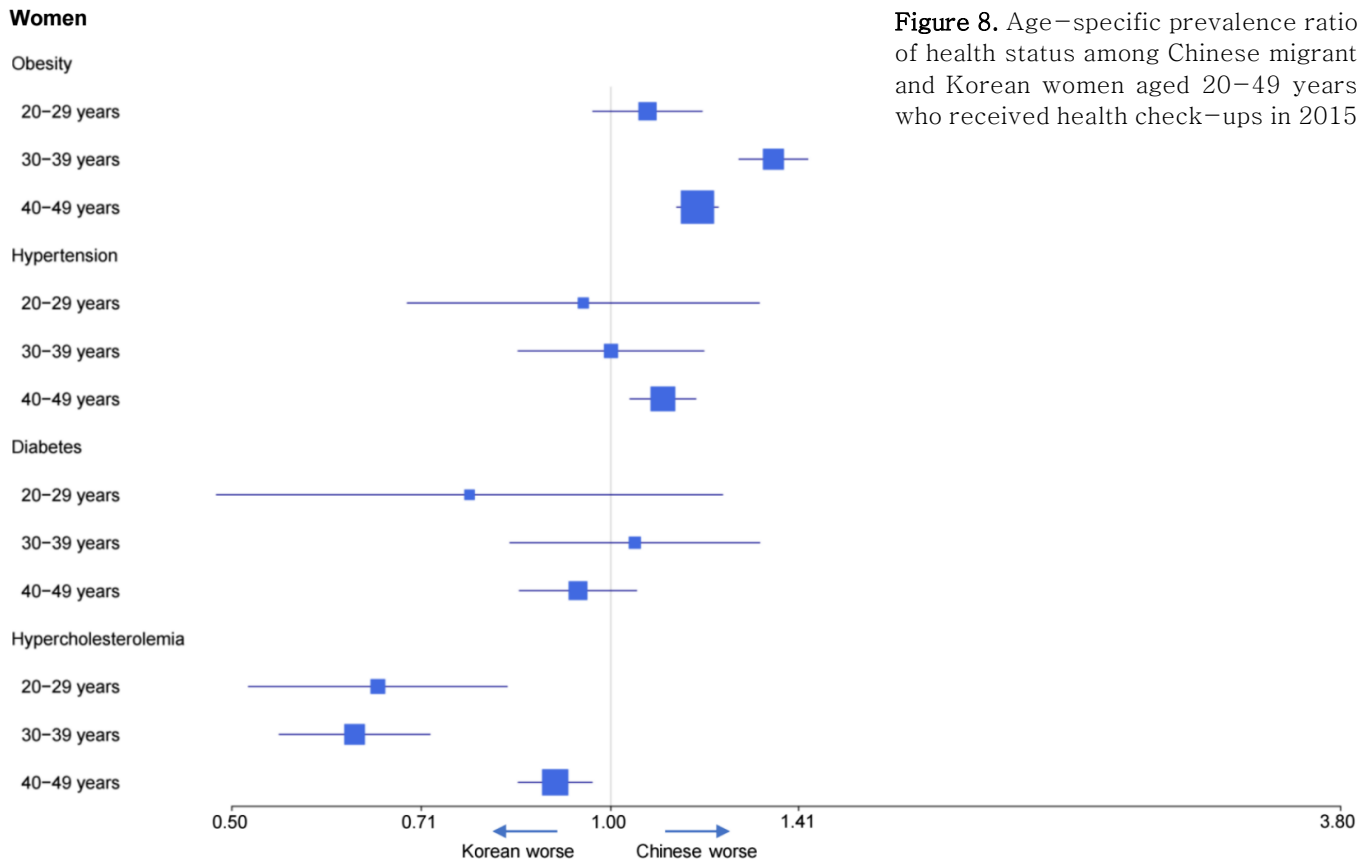


Figure 8. Age-specific prevalence ratio of health status among Chinese migrant and Korean women aged 20-49 years who received health check-ups in 2015

3.4 Prevalence of lifestyle factors, socioeconomic situation, and health status estimates among Filipino migrants, compared with the native population aged 20–49 years who received health check–ups, in 2015

In 2015, the age–adjusted prevalence of hypercholesterolemia in Filipino migrant men (10.3%) was higher than that in Korean men (11.7%) (P = 0.0103). However, the age–adjusted prevalence of obesity in Filipino migrant women (25.7%) was higher than that in Korean women (16.9%) (P < 0.0001). In addition, the age–adjusted prevalence of hypertension in Filipino migrant women (7.7%) was higher than that in Korean women (4.2%) (P < 0.0001). Moreover, the age–adjusted prevalence of diabetes in Filipino migrant women (2.6%) was higher than that in Korean women (1.8%) (P = 0.0090). Furthermore, the–adjusted prevalence of lifestyle factors, socioeconomic situation, and health status estimates among Filipino migrants, compared with the native population aged 20–49 years who received health check–ups are shown in Table 10.

Table 10. Age–adjusted prevalence of lifestyle factors, socioeconomic situation, and health status estimates among Filipino migrants, compared with the native population aged 20–49 years who received health check–ups, in 2015

Variable	Age-adjusted prevalence (95% CI)*		*P* value
	Korean	Filipino migrant	
Men, n	77,038	9,497	
Current smoker	46.5 (45.9–47.1)	23.3 (22.0–24.6)	< 0.0001
Any alcohol use	76.0 (75.3–76.8)	53.6 (51.5–55.6)	< 0.0001
Physical inactivity	23.0 (22.6–23.4)	48.3 (46.4–50.3)	< 0.0001
Low income level	8.8 (8.5–9.1)	29.5 (28.2–30.9)	< 0.0001
Obesity	43.1 (42.5–43.6)	40.0 (38.1–42.0)	0.0038
Hypertension	12.2 (11.9–12.4)	10.0 (9.0–11.1)	0.0005
Diabetes	4.3 (4.2–4.5)	3.9 (3.2–4.5)	0.2181
Hypercholesterolemia	10.3 (10.1–10.6)	11.7 (10.6–12.7)	0.0103
Women, n	59,074	2,254	
Current smoker	4.8 (4.5–5.0)	2.1 (1.5–2.8)	< 0.0001
Any alcohol use	49.0 (48.3–49.6)	13.6 (12.0–15.2)	< 0.0001
Physical inactivity	30.2 (29.7–30.7)	53.2 (49.9–56.5)	< 0.0001
Low income level	17.9 (17.5–18.3)	46.9 (43.8–50.0)	< 0.0001
Obesity	16.9 (16.5–17.2)	25.7 (23.2–28.2)	< 0.0001
Hypertension	4.2 (4.1–4.4)	7.7 (6.2–9.2)	< 0.0001
Diabetes	1.8 (1.7–1.9)	2.6 (1.9–3.4)	0.0090
Hypercholesterolemia	5.7 (5.5–5.9)	6.5 (5.2–7.9)	0.2457

* Data are expressed as %; age standardisation with 10-year age bands; the world standard population was used as the standard population.

With regard to age-specific prevalence, among participants aged 20-29 years, the prevalence of hypercholesterolemia in Filipino migrant men (7.4%) was higher than that in Korean men (5.4%). Among participants aged 30-39 years, the prevalence of hypercholesterolemia in Filipino migrant men (12.7%) was higher than that in Korean men (11.8%). However, among participants aged 20-29 years, the prevalence of obesity in Filipino migrant women (14.8%) was higher than that in Korean women (12.0%). Among participants aged 30-39 years, the prevalence of obesity in Filipino migrant women (24.2%) was higher than that in Korean women (16.6%). Among participants

aged 40–49 years, the prevalence of obesity in Filipino migrant women (41.4%) was higher than that in Korean women (23.5%). In addition, among participants aged 30–39 years, the prevalence of hypertension in Filipino migrant women (4.8%) was higher than that in Korean women (2.8%). Among participants aged 40–49 years, the prevalence of hypertension in Filipino migrant women (19.4%) was higher than that in Korean women (9.7%). Moreover, among participants aged 30–39 years, the prevalence of diabetes in Filipino migrant women (3.1%) was higher than that in Korean women (1.5%). Furthermore, among participants aged 40–49 years, the prevalence of hypercholesterolemia in Filipino migrant women (14.6%) was higher than that in Korean women (8.8%) (Figure 11 and Figure 12).

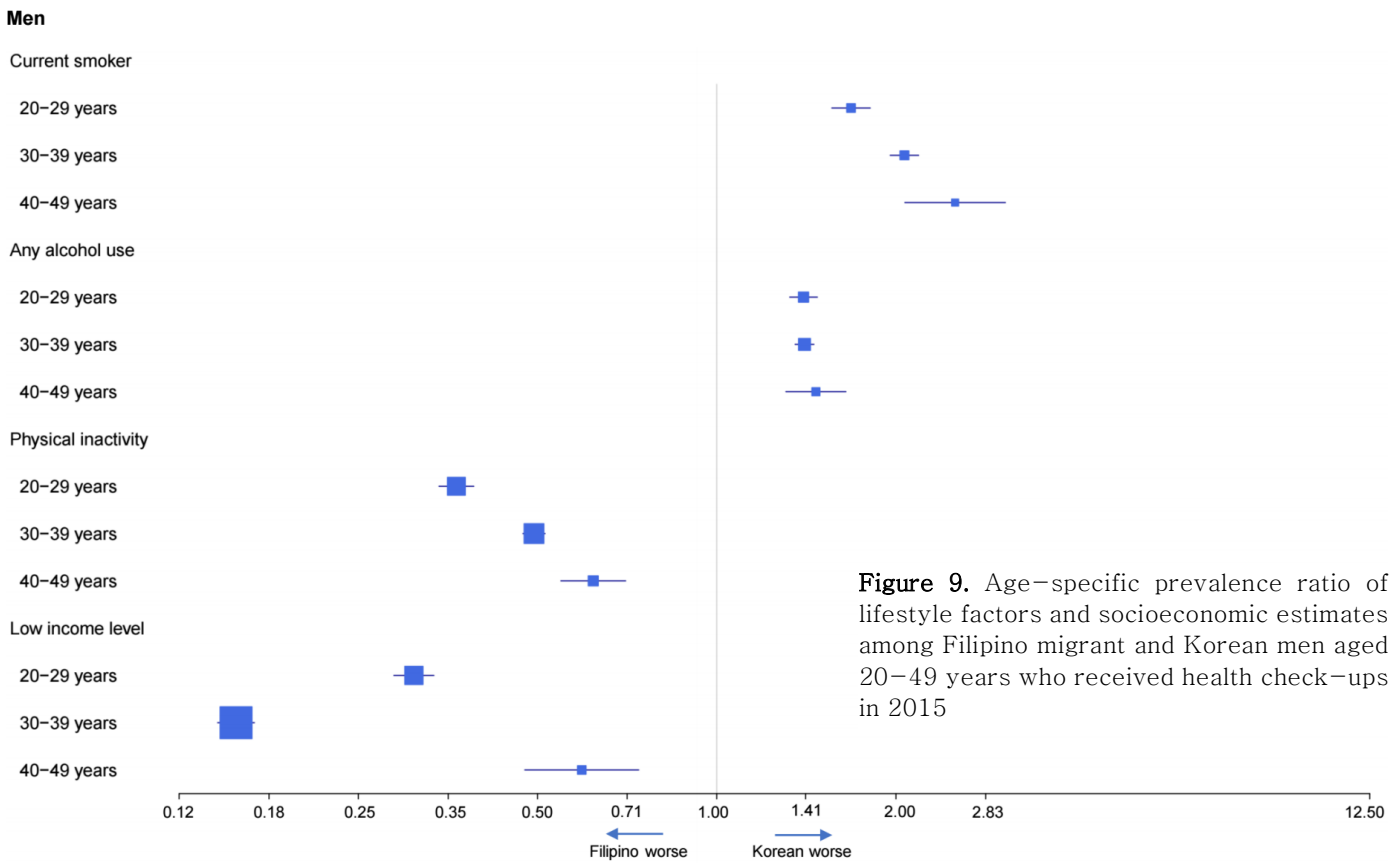


Figure 9. Age-specific prevalence ratio of lifestyle factors and socioeconomic estimates among Filipino migrant and Korean men aged 20-49 years who received health check-ups in 2015

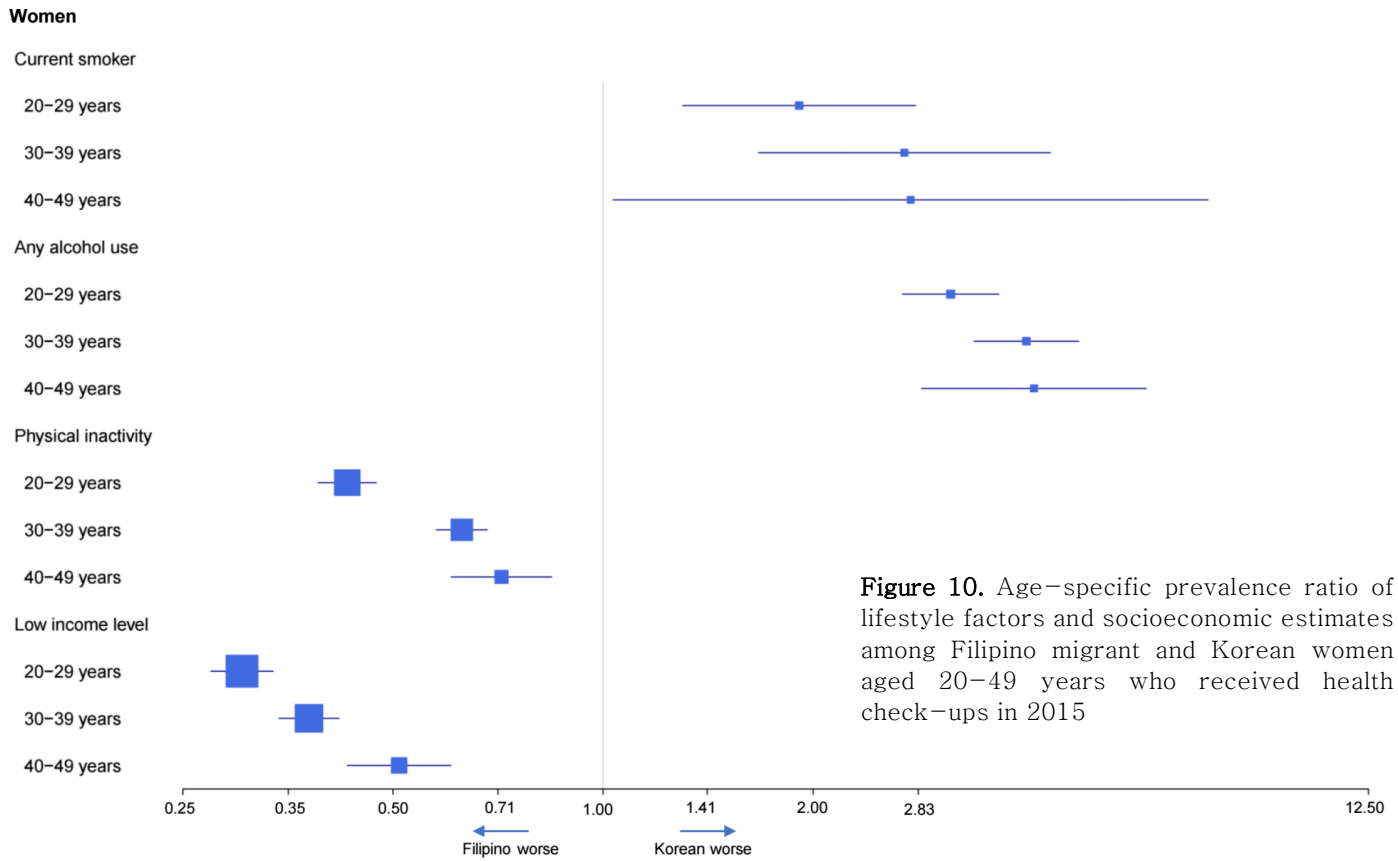


Figure 10. Age-specific prevalence ratio of lifestyle factors and socioeconomic estimates among Filipino migrant and Korean women aged 20-49 years who received health check-ups in 2015

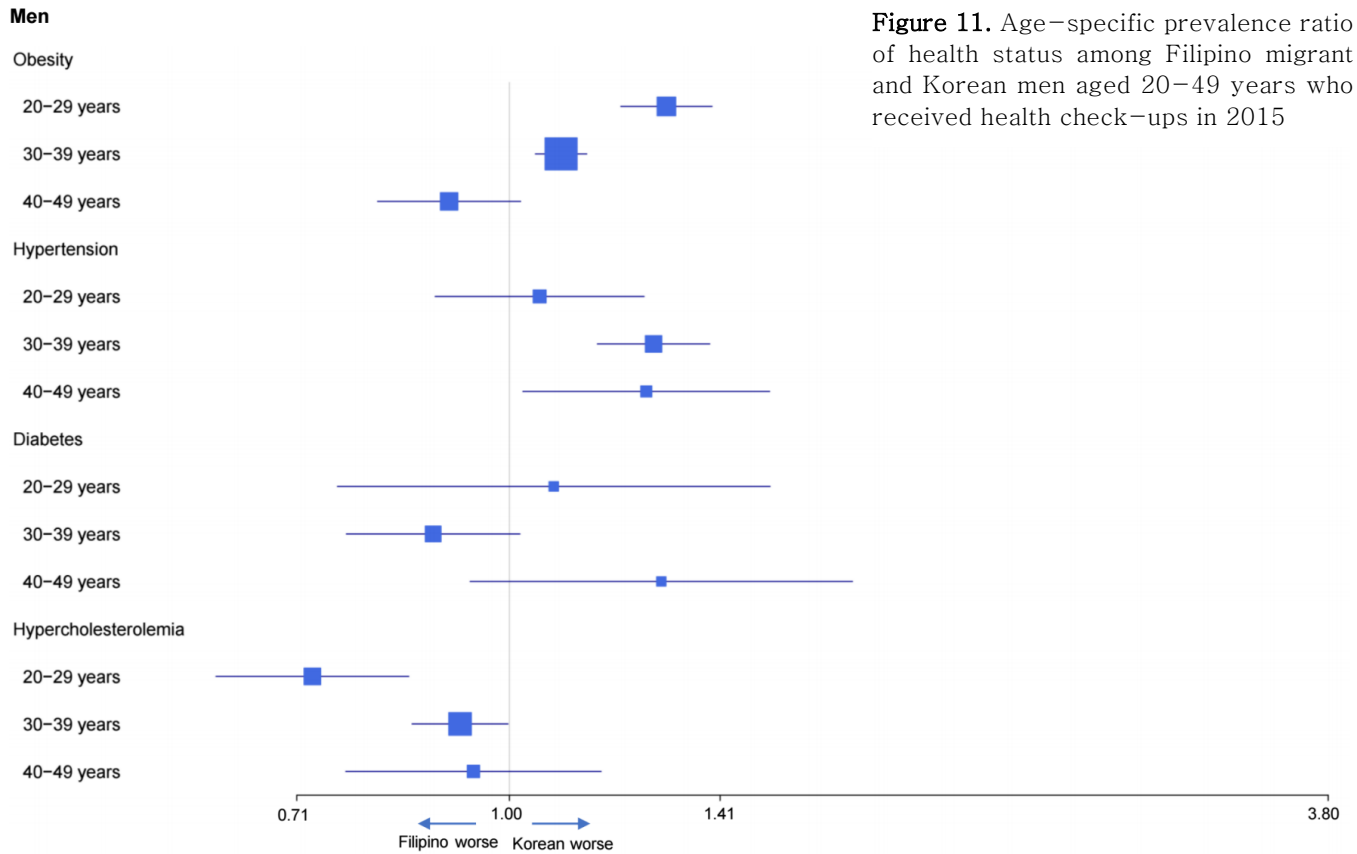


Figure 11. Age-specific prevalence ratio of health status among Filipino migrant and Korean men aged 20-49 years who received health check-ups in 2015

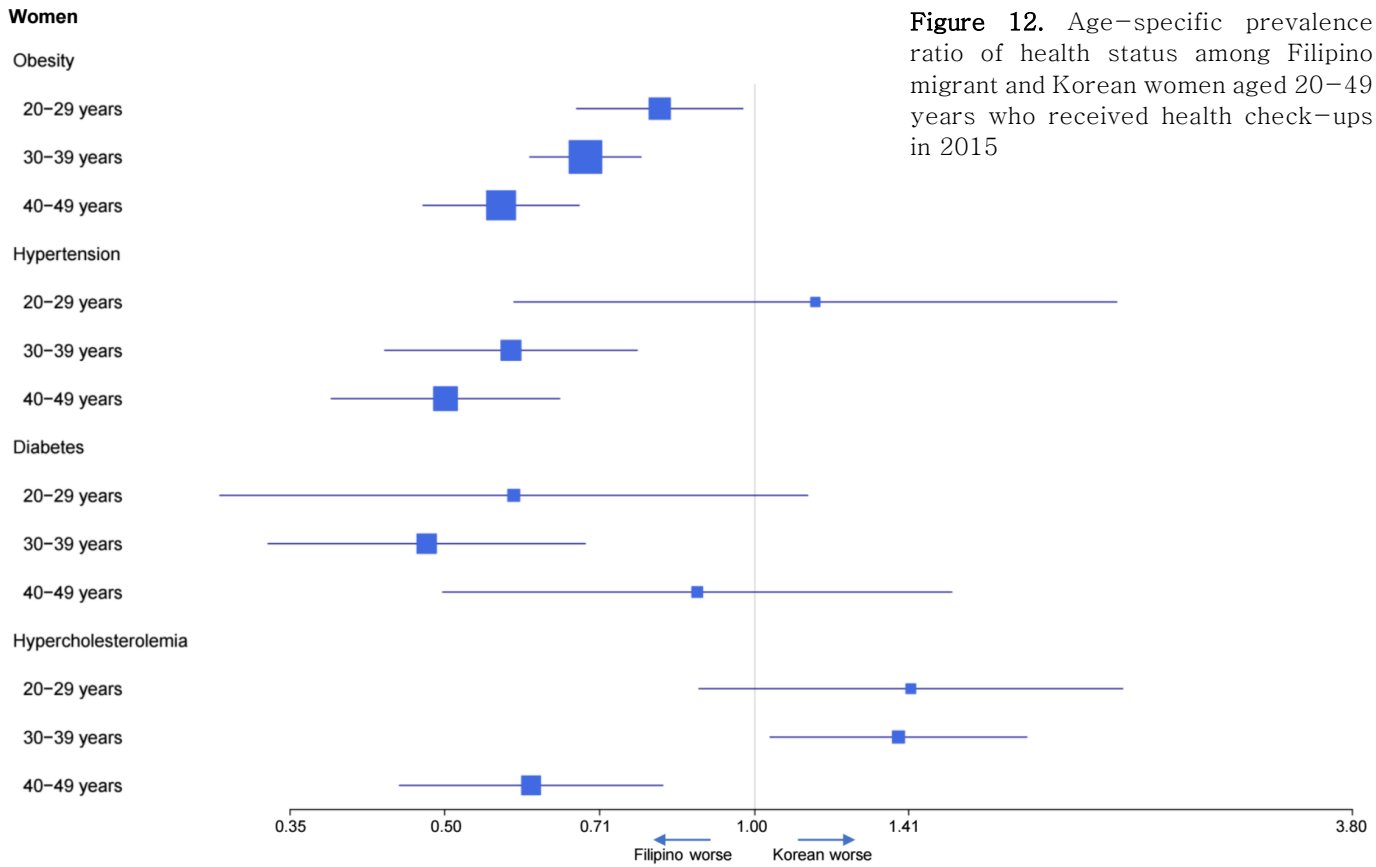


Figure 12. Age-specific prevalence ratio of health status among Filipino migrant and Korean women aged 20-49 years who received health check-ups in 2015

3.5 Prevalence of lifestyle factors, socioeconomic situation, and health status estimates among Vietnamese migrants, compared with the native population aged 20–49 years who received health check–ups, in 2015

In 2015, the–adjusted prevalence of lifestyle factors, socioeconomic situation, and health status estimates among Vietnamese migrants, compared with the native population aged 20–49 years who received health check–ups are shown in Table 11.

Table 11. Age–adjusted prevalence of lifestyle factors, socioeconomic situation, and health status estimates among Vietnamese migrants, compared with the native population aged 20–49 years who received health check–ups, in 2015

Variable	Age–adjusted prevalence (95% CI)*		*P* value
	Korean	Vietnamese migrant	
Men, n	77,038	13,373	
Current smoker	46.5 (45.9–47.1)	29.9 (28.0–31.8)	< 0.0001
Any alcohol use	76.0 (75.3–76.8)	52.8 (50.5–55.1)	< 0.0001
Physical inactivity	23.0 (22.6–23.4)	49.4 (47.1–51.7)	< 0.0001
Low income level	8.8 (8.5–9.1)	19.7 (18.3–21.0)	< 0.0001
Obesity	43.1 (42.5–43.6)	14.0 (12.6–15.5)	< 0.0001
Hypertension	12.2 (11.9–12.4)	5.1 (4.1–6.1)	< 0.0001
Diabetes	4.3 (4.2–4.5)	2.7 (2.0–3.4)	0.0002
Hypercholesterolemia	10.3 (10.1–10.6)	9.2 (7.9–10.5)	0.1070
Women, n	59,074	5,044	
Current smoker	4.8 (4.5–5.0)	2.5 (1.3–3.8)	0.0133
Any alcohol use	49.0 (48.3–49.6)	6.5 (5.8–7.3)	< 0.0001
Physical inactivity	30.2 (29.7–30.7)	55.5 (53.1–57.8)	< 0.0001
Low income level	17.9 (17.5–18.3)	43.5 (41.4–45.5)	< 0.0001

Obesity	16.9 (16.5–17.2)	9.1 (8.0–10.2)	< 0.0001
Hypertension	4.2 (4.1–4.4)	3.0 (2.3–3.7)	0.0037
Diabetes	1.8 (1.7–1.9)	1.6 (1.1–2.0)	0.4503
Hypercholesterolemia	5.7 (5.5–5.9)	5.3 (4.5–6.2)	0.3613

* Data are expressed as %; age standardisation with 10-year age bands; the world standard population was used as the standard population.

With regard to age-specific prevalence, among participants aged 40-49 years, the prevalence of hypercholesterolemia in Vietnamese migrant women (11.4%) was higher than that in Korean women (8.8%) (Figure 16).

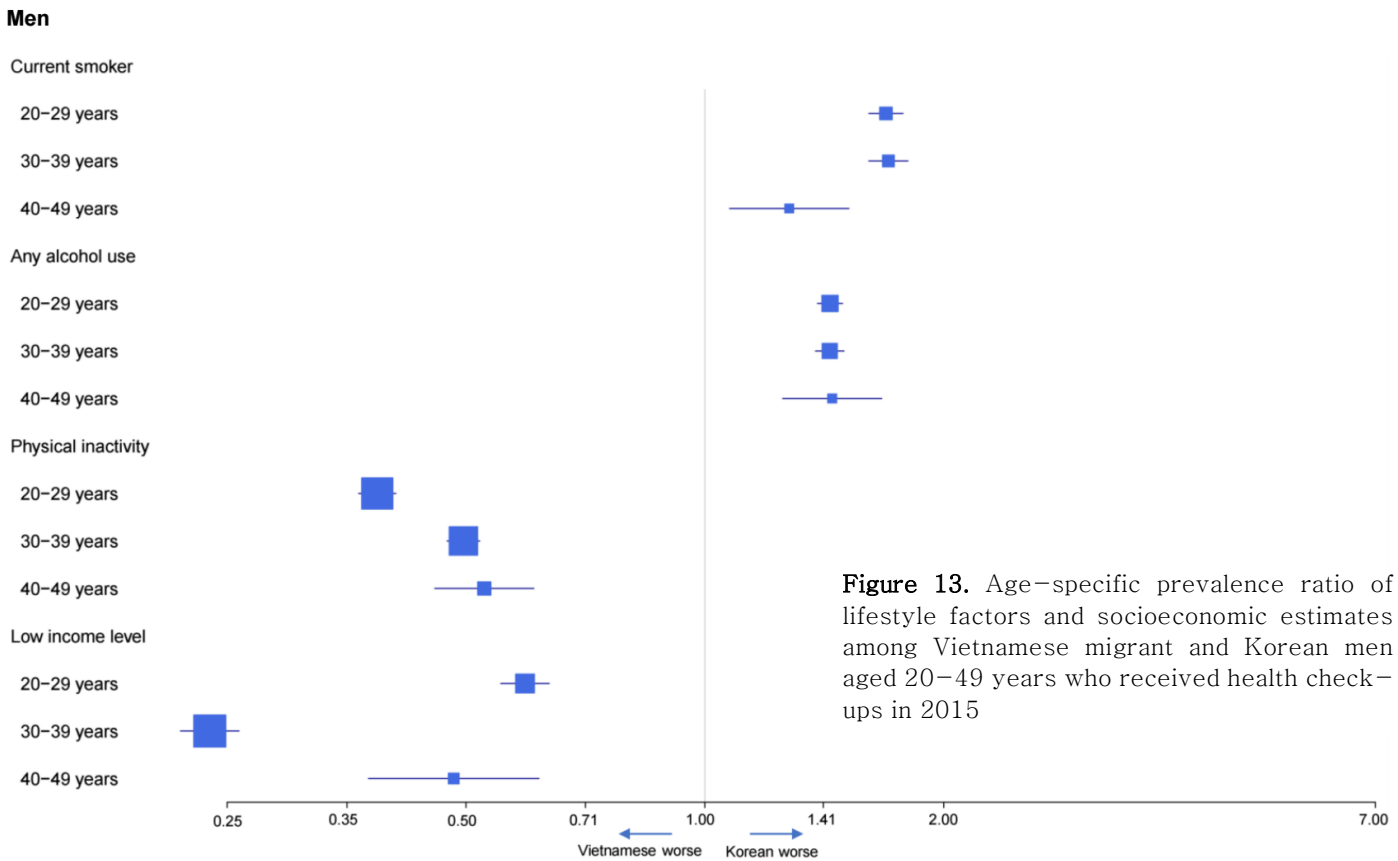


Figure 13. Age-specific prevalence ratio of lifestyle factors and socioeconomic estimates among Vietnamese migrant and Korean men aged 20-49 years who received health check-ups in 2015

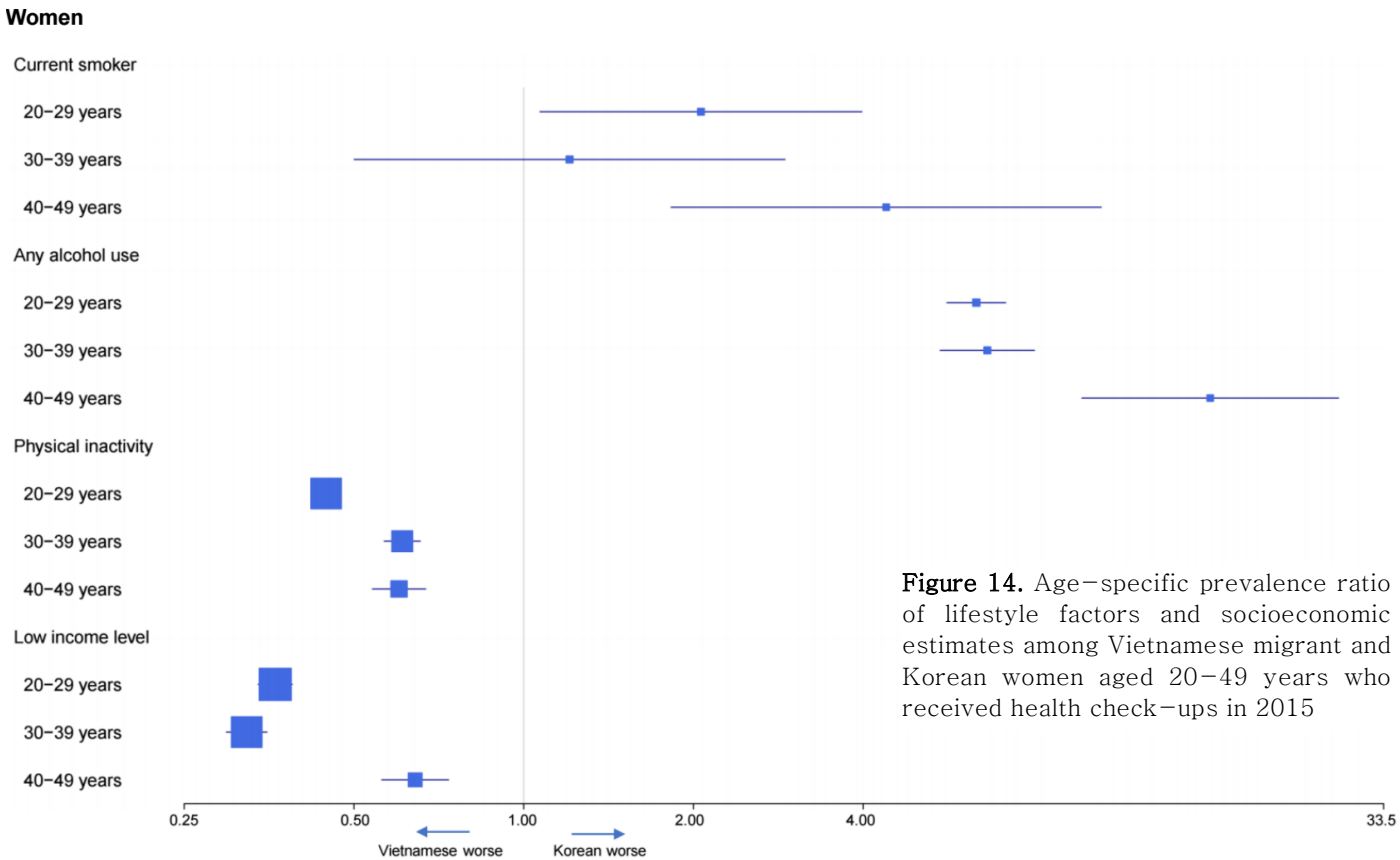


Figure 14. Age-specific prevalence ratio of lifestyle factors and socioeconomic estimates among Vietnamese migrant and Korean women aged 20-49 years who received health check-ups in 2015

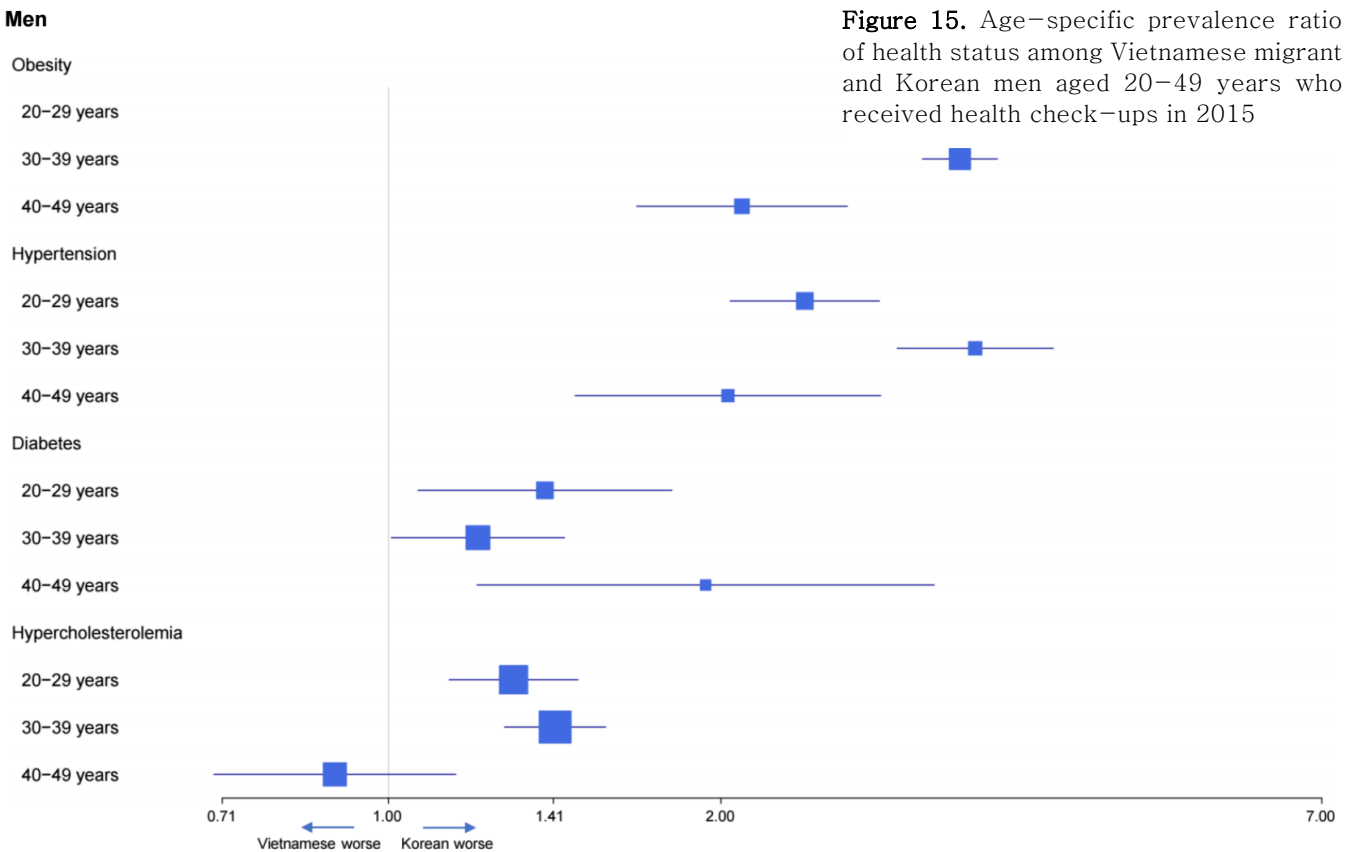


Figure 15. Age-specific prevalence ratio of health status among Vietnamese migrant and Korean men aged 20-49 years who received health check-ups in 2015

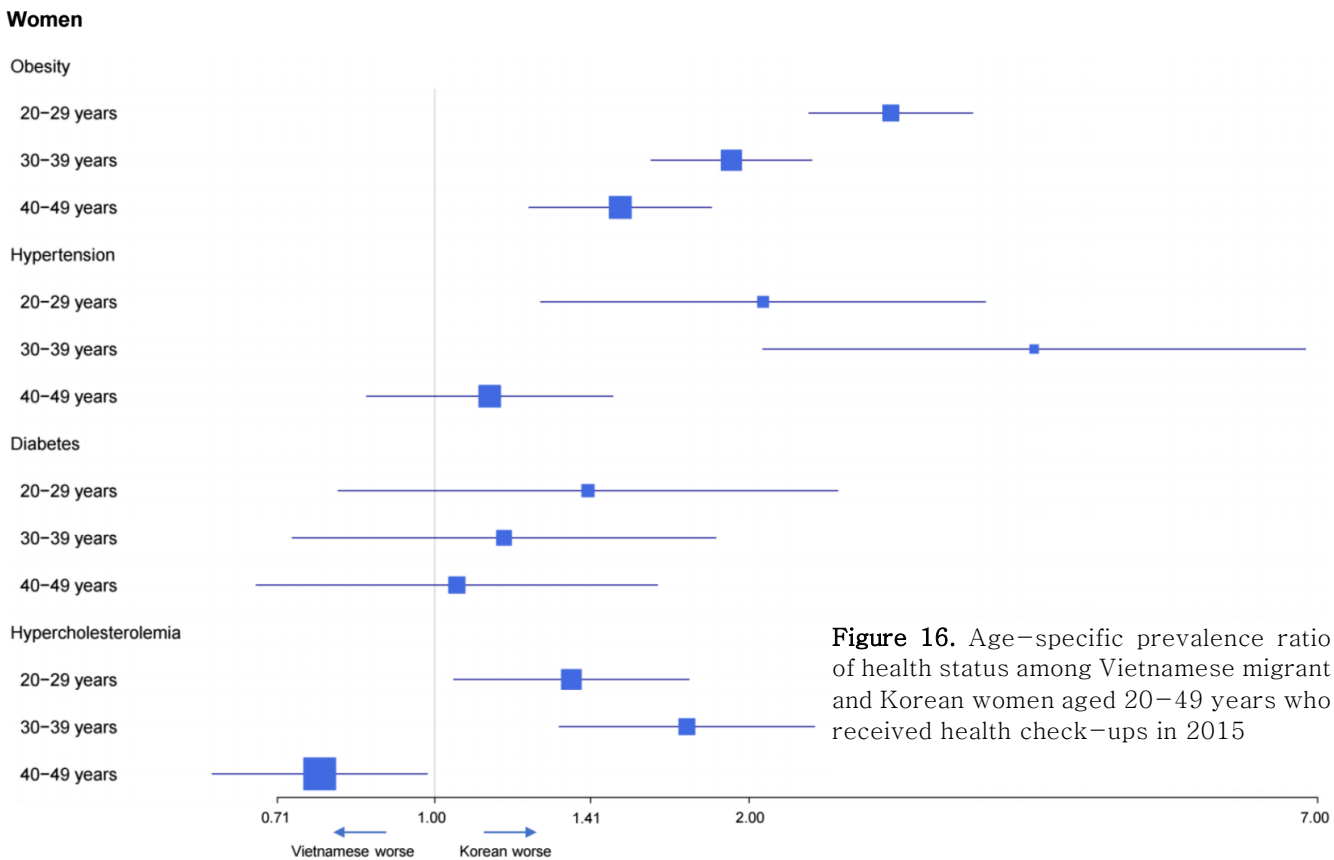


Figure 16. Age-specific prevalence ratio of health status among Vietnamese migrant and Korean women aged 20-49 years who received health check-ups in 2015

3.6 Prevalence of lifestyle factors, socioeconomic situation, and health status estimates among other Asian migrants, compared with the native population aged 20–49 years who received health check–ups, in 2015

In 2015, the–adjusted prevalence of lifestyle factors, socioeconomic situation, and health status estimates among other Asian migrants, compared with the native population aged 20–49 years who received health check–ups are shown in Table 12.

Table 12. Age–adjusted prevalence of lifestyle factors, socioeconomic situation, and health status estimates among other Asian migrants, compared with the native population aged 20–49 years who received health check–ups, in 2015

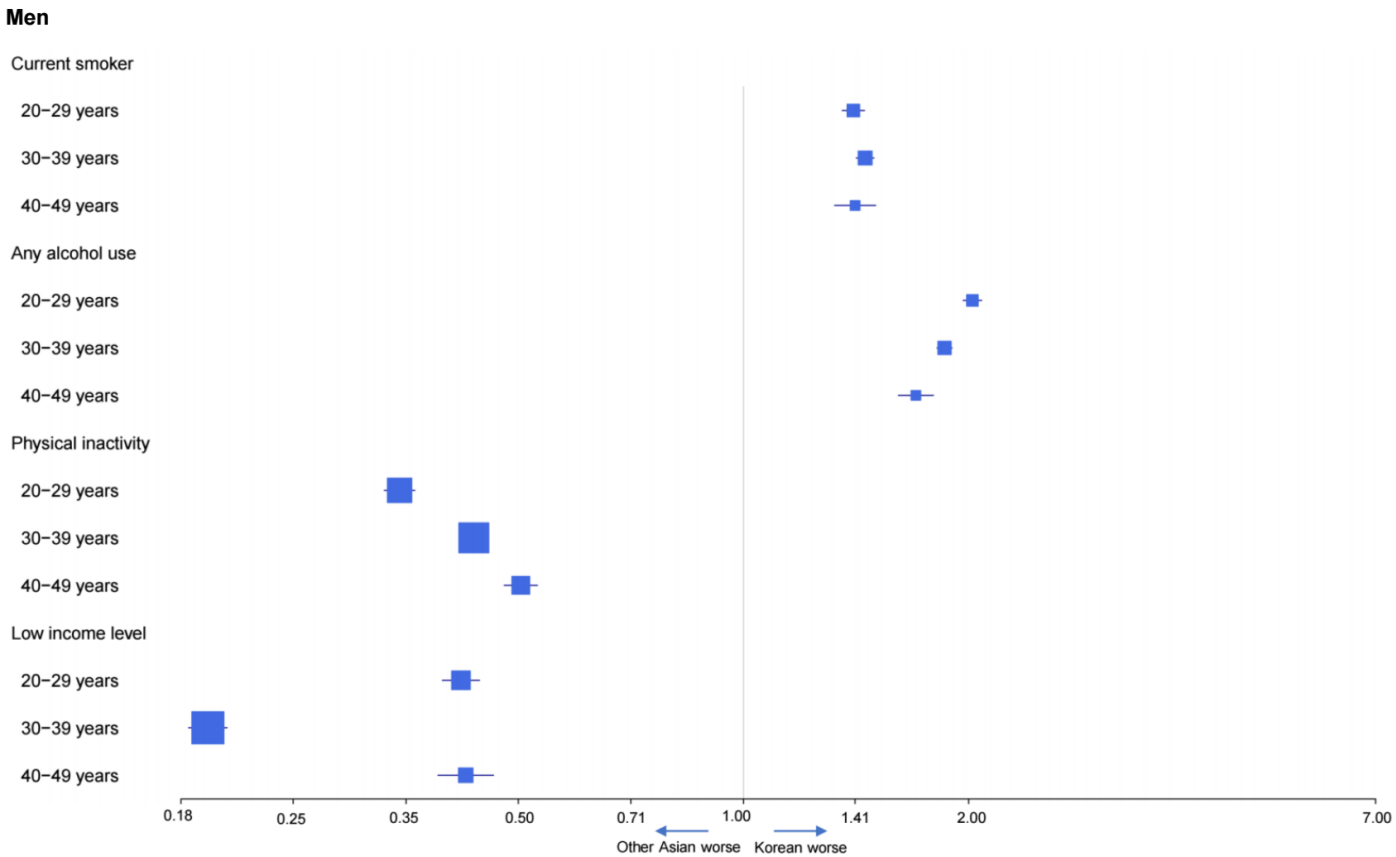
Variable	Age–adjusted prevalence (95% CI)*		*P* value
	Korean	Other Asian migrant	
Men, n	77,038	58,807	
Current smoker	46.5 (45.9–47.1)	32.7 (32.0–33.3)	< 0.0001
Any alcohol use	76.0 (75.3–76.8)	40.7 (40.0–41.5)	< 0.0001
Physical inactivity	23.0 (22.6–23.4)	54.4 (53.6–55.3)	< 0.0001
Low income level	8.8 (8.5–9.1)	25.2 (24.7–25.8)	< 0.0001
Obesity	43.1 (42.5–43.6)	31.3 (30.6–32.0)	< 0.0001
Hypertension	12.2 (11.9–12.4)	6.6 (6.2–7.0)	< 0.0001
Diabetes	4.3 (4.2–4.5)	3.4 (3.1–3.7)	< 0.0001
Hypercholesterolemia	10.3 (10.1–10.6)	9.5 (9.1–9.9)	0.0017
Women, n	59,074	4,321	
Current smoker	4.8 (4.5–5.0)	5.2 (4.5–5.9)	0.2511
Any alcohol use	49.0 (48.3–49.6)	14.5 (13.3–15.7)	< 0.0001
Physical inactivity	30.2 (29.7–30.7)	55.5 (53.2–57.8)	< 0.0001
Low income level	17.9 (17.5–18.3)	38.2 (36.3–40.1)	< 0.0001
Obesity	16.9 (16.5–17.2)	24.4 (22.7–26.0)	< 0.0001
Hypertension	4.2 (4.1–4.4)	4.5 (3.7–5.2)	0.4884

Diabetes	1.8 (1.7–1.9)	1.6 (2.1–1.2)	0.5624
Hypercholesterolemia	5.7 (5.5–5.9)	6.2 (5.4–7.0)	0.3124

* Data are expressed as %; age standardisation with 10-year age bands; the world standard population was used as the standard population.

With regard to age-specific prevalence, among participants aged 30-39 years, the prevalence of current smokers in other Asian migrant women (5.5%) was higher than that in Korean women (4.1%). Among participants aged 40-49 years, the prevalence of current smokers in other Asian migrant women (8.0%) was higher than that in Korean women (3.6%). Moreover, among participants aged 30-39 years, the prevalence of obesity in other Asian migrant women (23.8%) was higher than that in Korean women (16.6%). Among participants aged 40-49 years, the prevalence of obesity in other Asian migrant women (40.7%) was higher than that in Korean women (23.5%) (Figure 18 and Figure 20).

Figure 17. Age-specific prevalence ratio of lifestyle factors and socioeconomic estimates among other Asian migrant and Korean men aged 20-49 years who received health check-ups in 2015



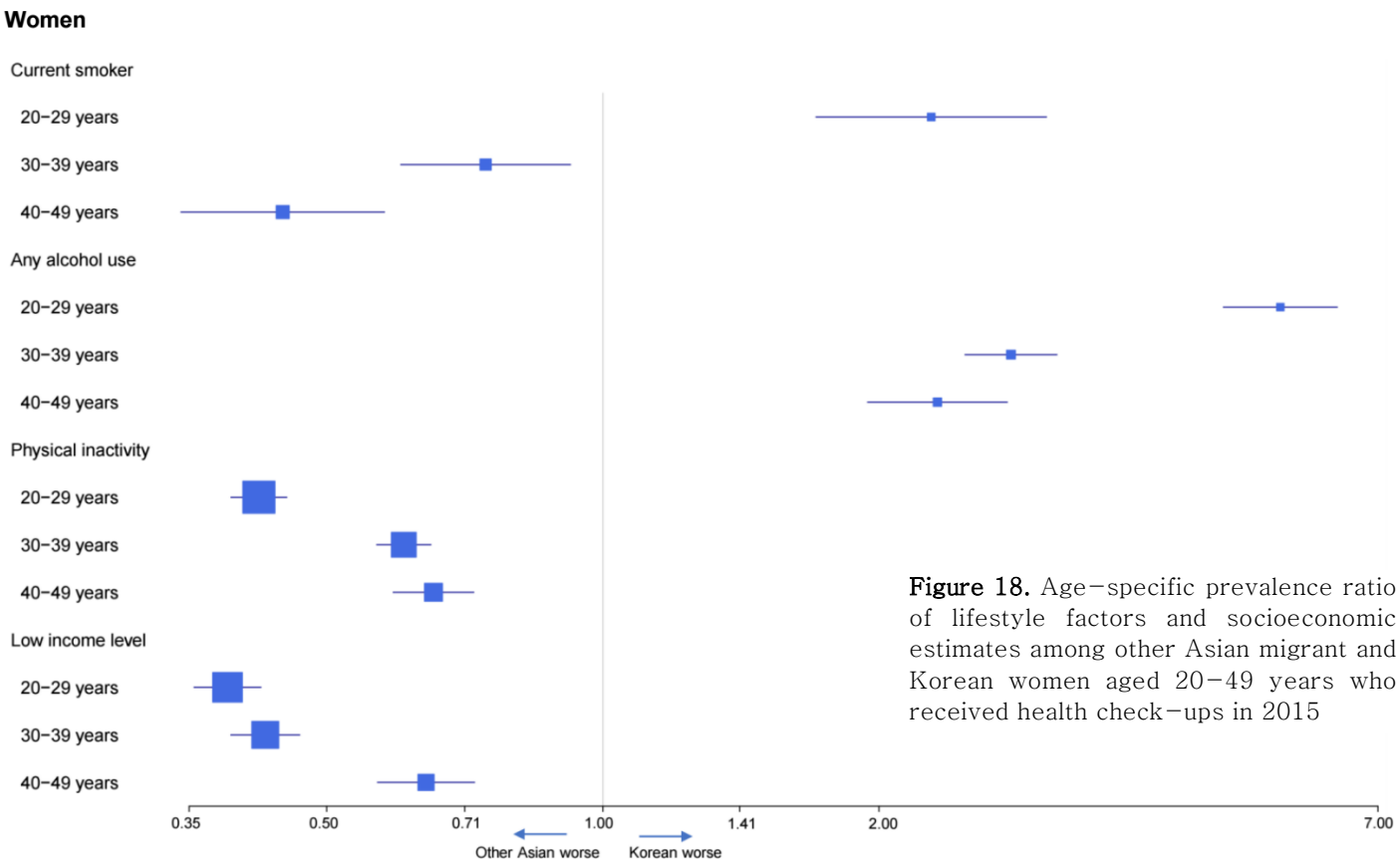


Figure 18. Age-specific prevalence ratio of lifestyle factors and socioeconomic estimates among other Asian migrant and Korean women aged 20-49 years who received health check-ups in 2015

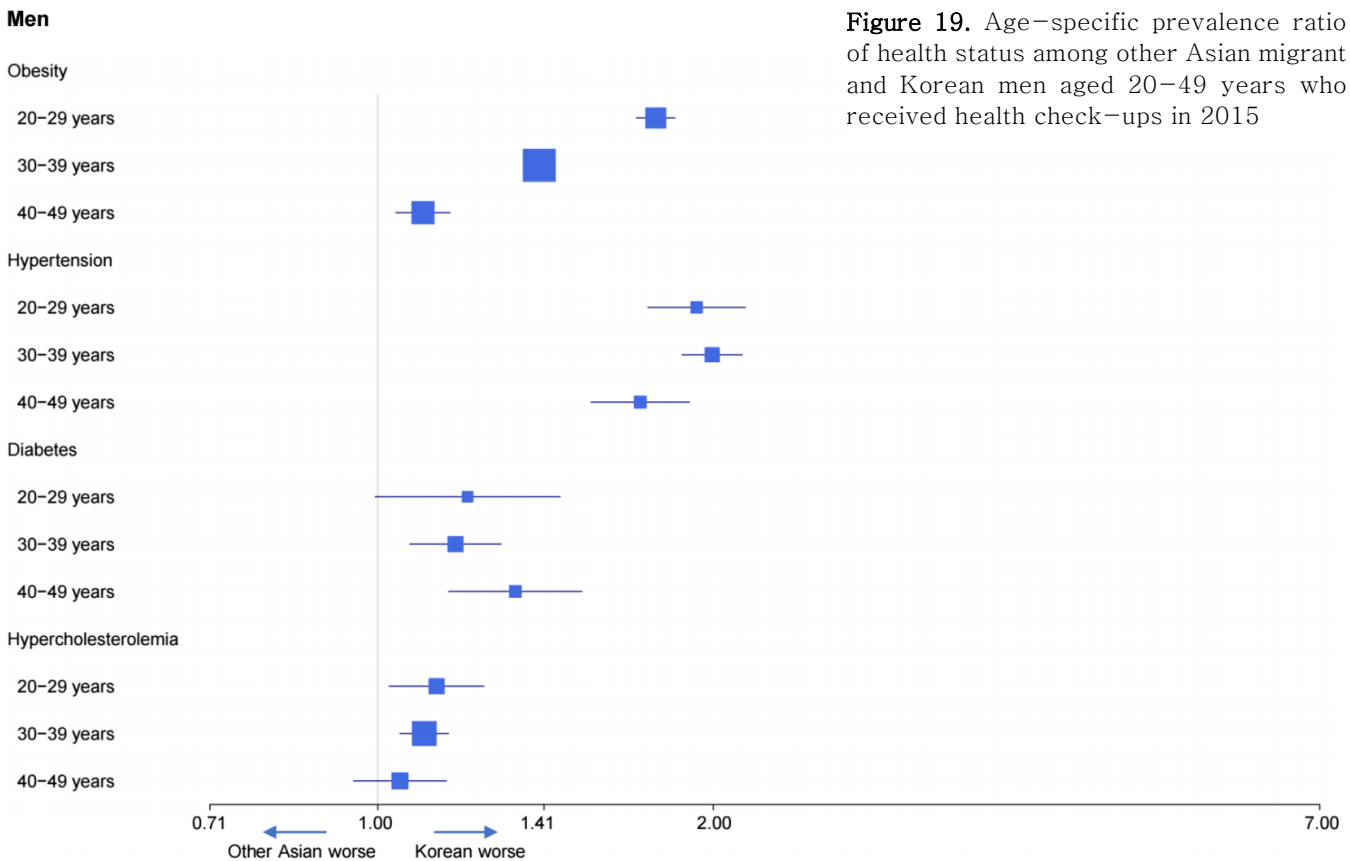


Figure 19. Age-specific prevalence ratio of health status among other Asian migrant and Korean men aged 20-49 years who received health check-ups in 2015

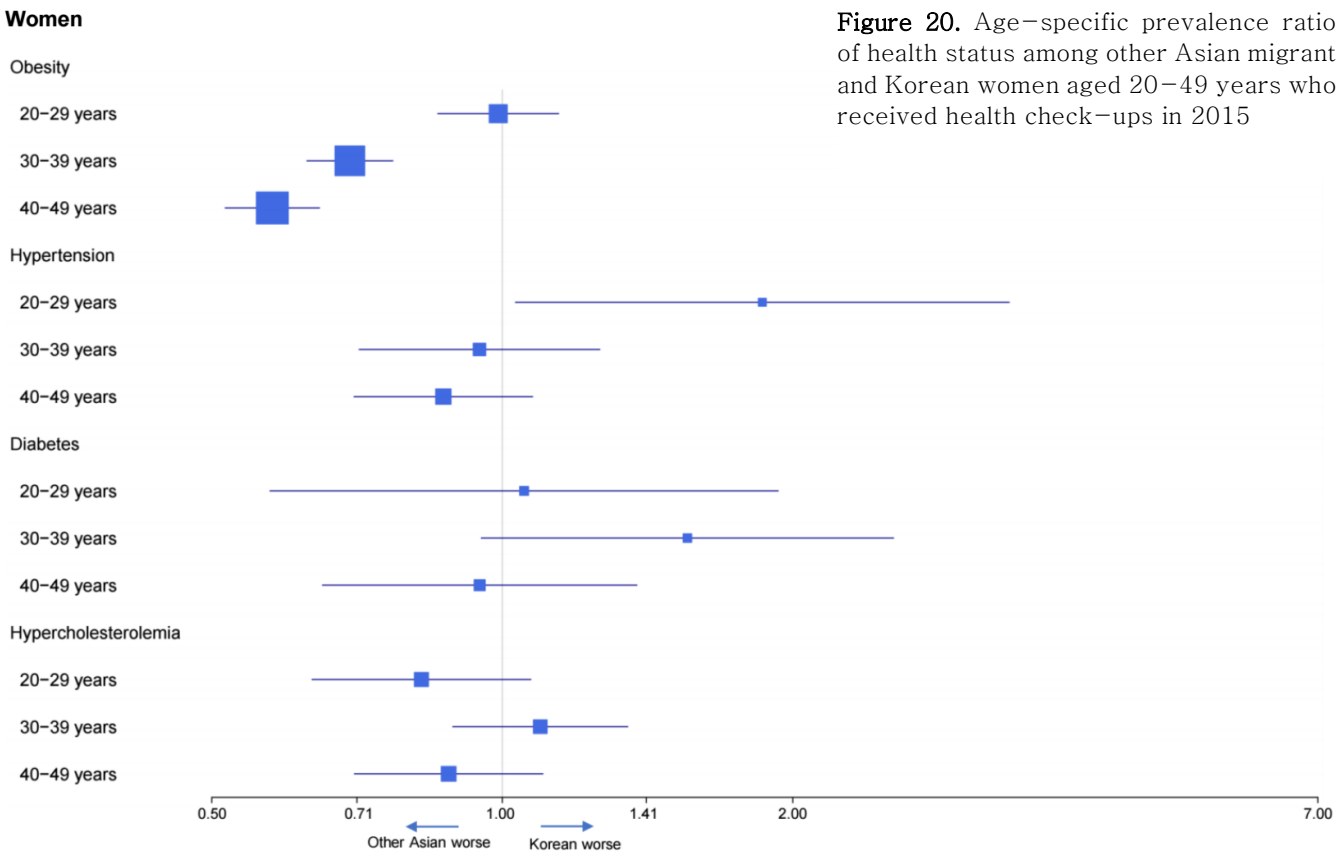


Figure 20. Age-specific prevalence ratio of health status among other Asian migrant and Korean women aged 20-49 years who received health check-ups in 2015

3.7 Age-adjusted prevalence of raised fasting blood glucose and raised blood pressure estimates among Chinese, Japanese, Filipino, and Vietnamese migrants, compared with Koreans in 2015

With regard to age-adjusted raised fasting blood glucose and raised blood pressure, the age-adjusted raised blood pressure in Chinese migrant men was 14.2% compared with Korean men (12.7%) (P < 0.0001). The age-adjusted raised blood pressure in Chinese migrant women was 8.2% compared with Korean women (7.7%) (P = 0.0015) (Table 13).

Table 13. Age-adjusted prevalence of raised fasting blood glucose and raised blood pressure estimates among Chinese migrants, compared with the native population aged 20 years and older who received health check-ups, in 2015

Variable	Age-adjusted prevalence (95% CI)*		*P* value
	Korean	Chinese migrant	
Men, n	141,312	53,415	
Raised fasting blood glucose	7.3 (7.1–7.4)	6.1 (5.8–6.3)	< 0.0001
Raised blood pressure	12.7 (12.5–12.9)	14.2 (13.8–14.5)	< 0.0001
Women, n	124,850	47,808	
Raised fasting blood glucose	3.9 (3.8–4.0)	3.1 (2.9–3.2)	< 0.0001
Raised blood pressure	7.7 (7.6–7.8)	8.2 (7.9–8.5)	0.0015

* Data are expressed as %; age standardisation with 10-year age bands; the world standard population was used as the standard population; raised fasting blood glucose was defined as fasting blood glucose ≥ 126 mg/dL; raised blood pressure was defined as blood pressure ≥ 140/90 mm Hg.

Table 14. Age-adjusted prevalence of raised fasting blood glucose and raised blood pressure estimates among Japanese migrants, compared with the native population who received health check-ups, in 2015

Variable	Age-adjusted prevalence (95% CI)*		*P* value
	Korean	Japanese	
Men, n	141,312	1,274	
Raised fasting blood glucose †	9.2 (9.1–9.4)	6.1 (4.6–7.5)	0.0007
Raised blood pressure ‡	12.7 (12.5–12.9)	11.0 (8.8–13.2)	0.162
Women, n	124,850	3,171	
Raised fasting blood glucose †	4.9 (4.8–5.1)	3.7 (2.5–5.0)	0.1071
Raised blood pressure ‡	7.7 (7.6–7.8)	5.9 (4.5–7.2)	0.0187

* Data are expressed as %; age standardisation with 10-year age bands; the world standard population was used as the standard population; raised fasting blood glucose was defined as fasting blood glucose ≥ 126 mg/dL; raised blood pressure was defined as blood pressure ≥ 140/90 mm Hg.
† Aged 30 years and older.
‡ Aged 20 years and older.

Table 15. Age-adjusted prevalence of raised fasting blood glucose and raised blood pressure estimates among Filipino migrants, compared with the native population aged 20 years and older who received health check-ups, in 2015

Variable	Age-adjusted prevalence (95% CI)*		*P* value
	Korean	Filipino migrant	
Men, n	141,312	9,541	
Raised fasting blood glucose	7.3 (7.1–7.4)	7.5 (2.0–13.0)	0.9345
Raised blood pressure	12.7 (12.5–12.9)	9.3 (4.0–14.6)	0.2793
Women, n	124,850	2,347	
Raised fasting blood glucose	3.9 (3.8–4.0)	4.3 (1.4–7.3)	0.7377
Raised blood pressure	7.7 (7.6–7.8)	10.6 (6.7–14.6)	0.0896

* Data are expressed as %; age standardisation with 10-year age bands; the world standard population was used as the standard population; raised fasting blood glucose was defined as fasting blood glucose ≥ 126 mg/dL; raised blood pressure was defined as blood pressure ≥ 140/90 mm Hg.

Table 16. Age-adjusted prevalence of raised fasting blood glucose and raised blood pressure estimates among Vietnamese migrants, compared with the native population aged 20 years and older who received health check-ups, in 2015

Variable	Age-adjusted prevalence (95% CI)*		*P* value
	Korean	Vietnamese	
Men, n	141,312	13,624	
Raised fasting blood glucose	7.3 (7.1–7.4)	3.1 (1.8–4.4)	< 0.0001
Raised blood pressure	12.7 (12.5–12.9)	6.9 (4.8–9.0)	< 0.0001

Women, n	124,850	5,600	
Raised fasting blood glucose	3.9 (3.8–4.0)	3.7 (2.3–5.1)	0.829
Raised blood pressure	7.7 (7.6–7.8)	7.0 (5.2–8.8)	0.4502

* Data are expressed as %; age standardisation with 10−year age bands; the world standard population was used as the standard population; raised fasting blood glucose was defined as fasting blood glucose ≥ 126 mg/dL; raised blood pressure was defined as blood pressure ≥ 140/90 mm Hg.

Table 17. Age−adjusted prevalence of raised fasting blood glucose and raised blood pressure estimates among other Asian migrants, compared with the native population aged 20 years and older who received health check−ups, in 2015

Variable	Age−adjusted prevalence (95% CI)*		*P* value
	Korean	Other Asian migrant	
Men, n	141,312	59,117	
Raised fasting blood	7.3 (7.1–7.4)	4.6 (3.3–5.9)	0.0014
Raised blood pressure	12.7 (12.5–12.9)	12.7 (9.9–15.5)	0.9923
Women, n	124,850	4,648	
Raised fasting blood	3.9 (3.8–4.0)	4.2 (2.6–5.8)	0.6857
Raised blood pressure	7.7 (7.6–7.8)	8.2 (5.9–10.4)	0.6899

* Data are expressed as %; age standardisation with 10−year age bands; the world standard population was used as the standard population; raised fasting blood glucose was defined as fasting blood glucose ≥ 126 mg/dL; raised blood pressure was defined as blood pressure ≥ 140/90 mm Hg.

3.8 Prevalence of raised fasting blood glucose and raised blood pressure estimates among Chinese, Filipino, and Vietnamese migrants, compared with Koreans, aged 20–49 years who received health check–ups, in 2015

In 2015, the age–adjusted prevalence of raised fasting blood glucose, and raised blood pressure estimates among Chinese migrants, compared with the native population aged 20–49 years who received health check–ups are shown in Table 18.

Table 18. Age–adjusted prevalence of raised fasting blood glucose and raised blood pressure estimates among Chinese migrants, compared with the native population aged 20–49 years who received health check–ups, in 2015

Variable	Age–adjusted prevalence (95% CI)*		*P* value
	Korean	Chinese migrant	
Men, n	77,038	32,194	
Raised fasting blood glucose	3.8 (3.7–3.9)	4.0 (3.8–4.2)	0.2378
Raised blood pressure	9.1 (8.9–9.4)	9.0 (8.7–9.3)	0.5184
Women, n	59,074	25,966	
Raised fasting blood glucose	1.5 (1.4–1.6)	1.4 (1.2–1.5)	0.2063
Raised blood pressure	3.0 (2.9–3.1)	3.1 (2.9–3.3)	0.4218

* Data are expressed as %; age standardisation with 10–year age bands; the world standard population was used as the standard population; raised fasting blood glucose was defined as fasting blood glucose ≥ 126 mg/dL; raised blood pressure was defined as blood pressure ≥ 140/90 mm Hg.

With regard to age-specific prevalence, among participants aged 40-49 years, the prevalence of raised blood pressure in Chinese migrant women (6.8%) was higher than that in Korean women (6.2%) (Figure 21).

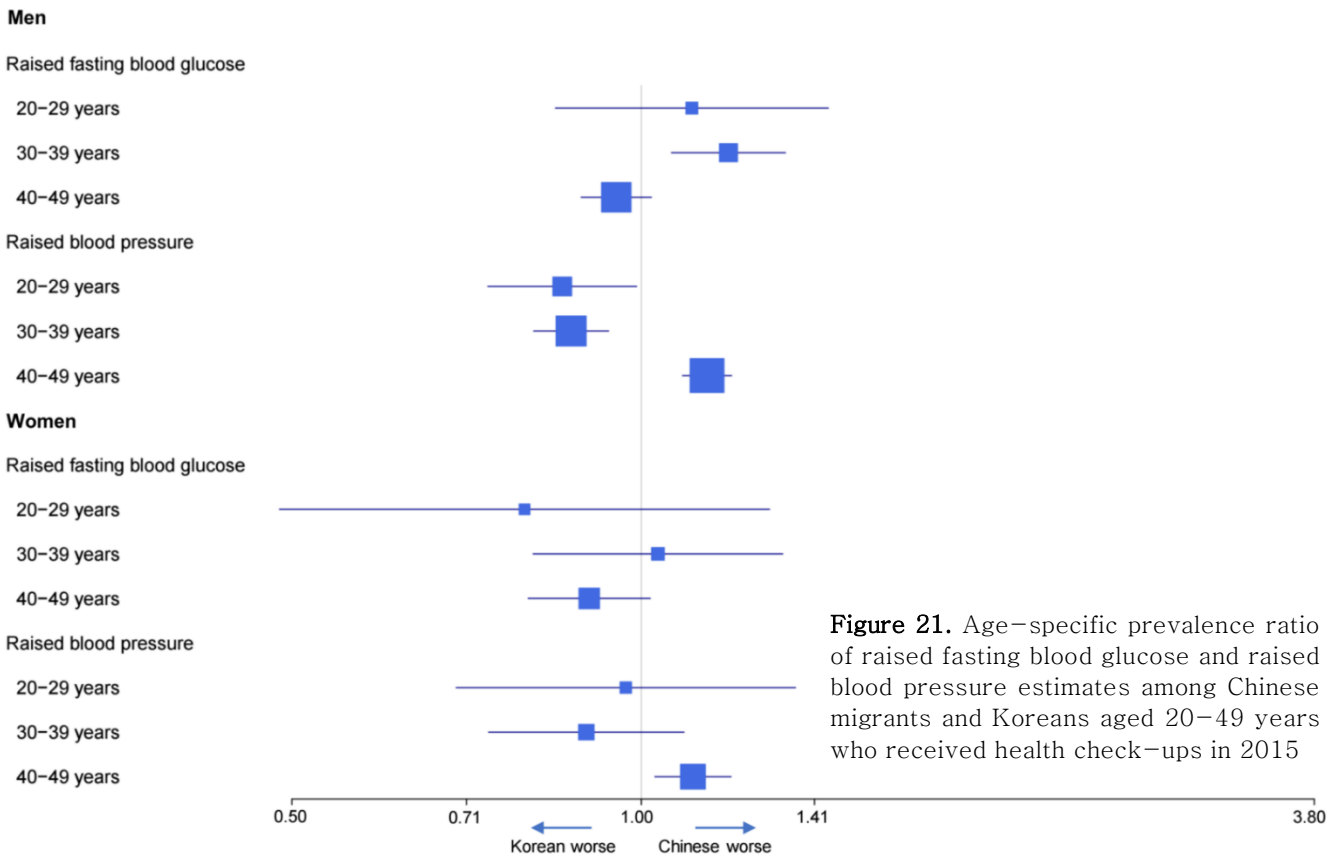


Figure 21. Age-specific prevalence ratio of raised fasting blood glucose and raised blood pressure estimates among Chinese migrants and Koreans aged 20–49 years who received health check-ups in 2015

In 2015, the age-adjusted prevalence of raised fasting blood glucose in Filipino migrant women (2.3%) was higher than that in Korean women (1.5%) (P = 0.0090). In addition, the age-adjusted prevalence of raised blood pressure in Filipino migrant women (5.6%) was higher than that in Korean women (3.0%) (P < 0.0001) (Table 19).

Table 19. Age-adjusted prevalence of raised fasting blood glucose and raised blood pressure estimates among Filipino migrants, compared with the native population aged 20-49 years who received health check-ups, in 2015

Variable	Age-adjusted prevalence (95% CI)*		*P* value
	Korean	Filipino migrant	
Men, n	77,038	9,497	
Raised fasting blood glucose	3.8 (3.7-3.9)	3.6 (3.0-4.3)	0.6276
Raised blood pressure	9.1 (8.9-9.4)	8.8 (7.8-9.8)	0.5518
Women, n	59,074	2,254	
Raised fasting blood glucose	1.5 (1.4-1.6)	2.3 (1.5-3.0)	0.0090
Raised blood pressure	3.0 (2.9-3.1)	5.6 (4.3-6.9)	< 0.0001

* Data are expressed as %; age standardisation with 10-year age bands; the world standard population was used as the standard population; raised fasting blood glucose was defined as fasting blood glucose ≥ 126 mg/dL; raised blood pressure was defined as blood pressure ≥ 140/90 mm Hg.

With regard to age-specific prevalence, among participants aged 30-39 years, the prevalence of raised fasting blood glucose in Filipino migrant men (3.8%) was higher than that in Korean men (3.2%). In addition, among participants aged 30-39 years, the prevalence of raised fasting blood glucose in Filipino migrant women (2.8%) was higher than that in Korean women (1.3%). Moreover, among participants aged 30-39 years, the prevalence of raised blood pressure in Filipino migrant women (3.4%) was higher than that in Korean women (2.3%). Among participants aged 40-49 years, the prevalence of raised blood pressure in Filipino migrant women (14.2%) was higher than that in Korean women (6.2%) (Figure 22).

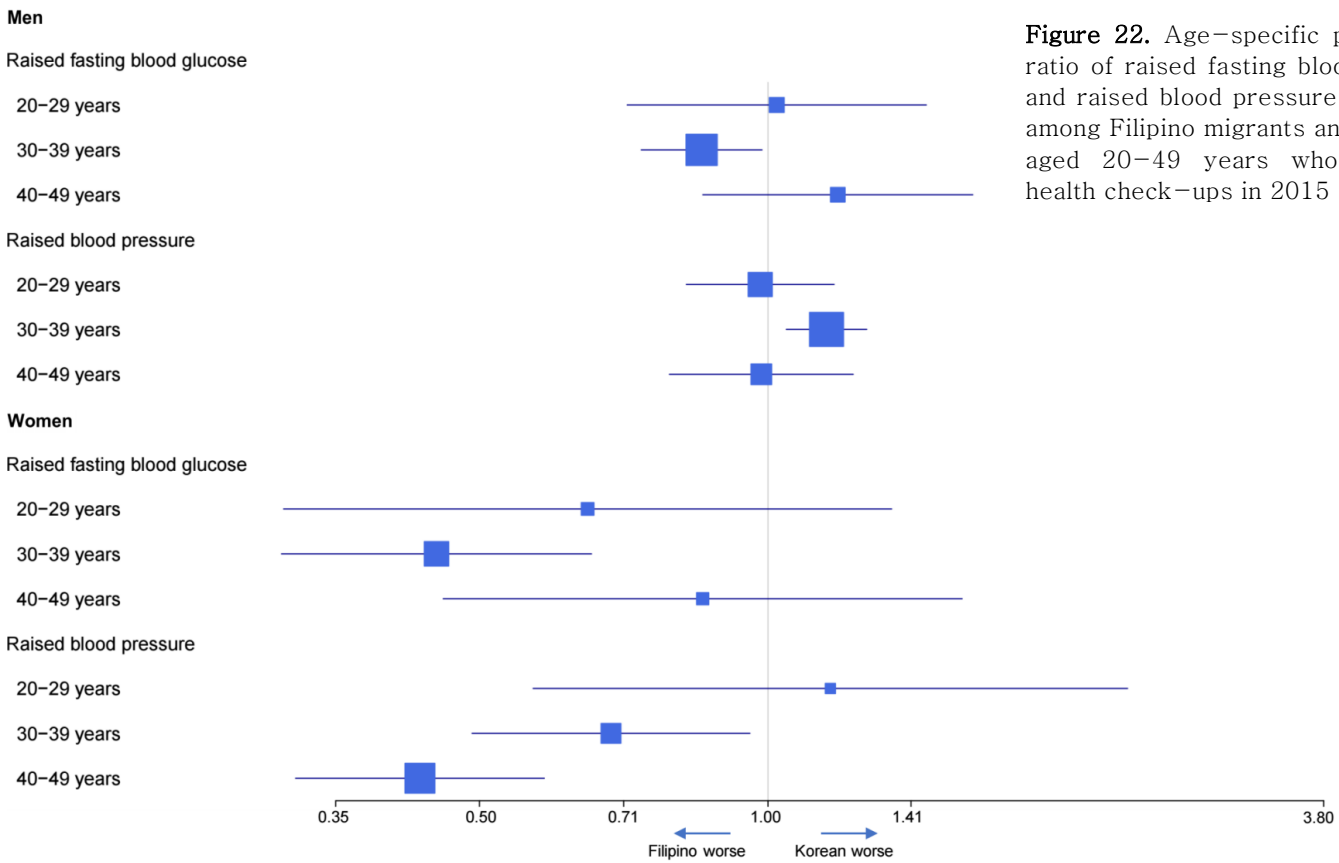


Figure 22. Age–specific prevalence ratio of raised fasting blood glucose and raised blood pressure estimates among Filipino migrants and Koreans aged 20–49 years who received health check–ups in 2015

In 2015, the prevalence of raised fasting blood glucose, and raised blood pressure estimates among Vietnamese migrants, compared with the native population aged 20–49 years who received health check–ups are shown in Table 20, Figure 23, and Figure 24.

Table 20. Age–adjusted prevalence of raised fasting blood glucose and raised blood pressure estimates among Vietnamese migrants, compared with the native population aged 20–49 years who received health check–ups, in 2015

Variable	Age–adjusted prevalence (95% CI)*		*P* value
	Korean	Vietnamese migrant	
Men, n	77,038	13,373	
Raised fasting blood glucose	3.8 (3.7–3.9)	2.3 (1.7–3.0)	0.0003
Raised blood pressure	9.1 (8.9–9.4)	4.3 (3.4–5.2)	< 0.0001
Women, n	59,074	5,044	
Raised fasting blood glucose	1.5 (1.4–1.6)	1.3 (0.9–1.7)	0.4757
Raised blood pressure	3.0 (2.9–3.1)	2.2 (1.6–2.8)	0.0295

* Data are expressed as %; age standardisation with 10–year age bands; the world standard population was used as the standard population; raised fasting blood glucose was defined as fasting blood glucose ≥ 126 mg/dL; raised blood pressure was defined as blood pressure ≥ 140/90 mm Hg.

Figure 23. Age-specific prevalence ratio of raised fasting blood glucose and raised blood pressure estimates among Vietnamese migrant and Korean men aged 20-49 years who received health check-ups in 2015

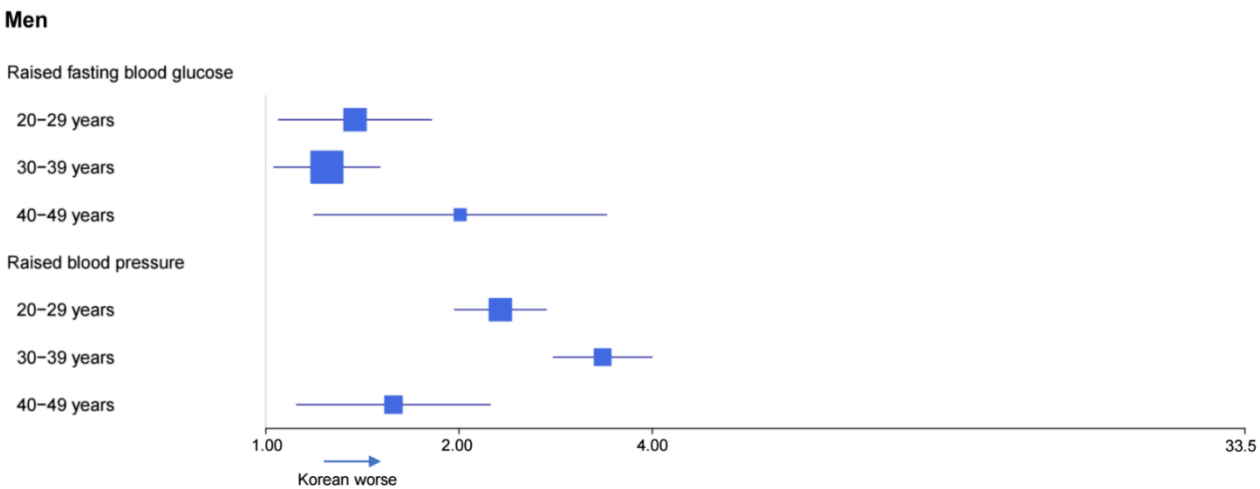
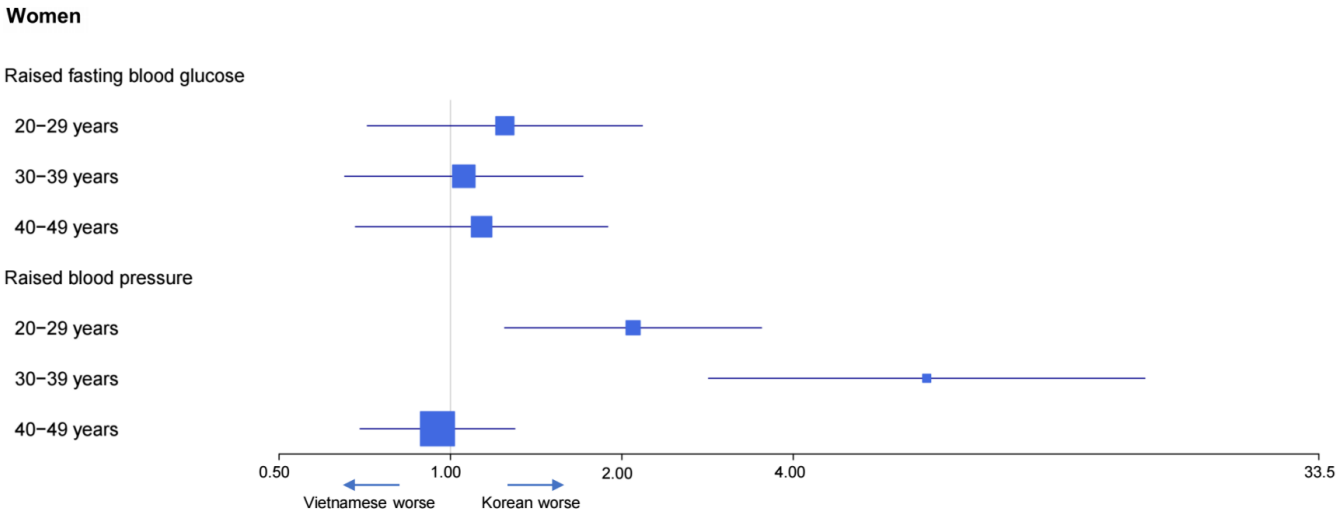


Figure 24. Age-specific prevalence ratio of raised fasting blood glucose and raised blood pressure estimates among Vietnamese migrant and Korean women aged 20-49 years who received health check-ups in 2015



In 2015, the age-adjusted prevalence of raised fasting blood glucose, and raised blood pressure estimates among other Asian migrants, compared with the native population aged 20-49 years who received health check-ups are shown in Table 21.

Table 21. Age-adjusted prevalence of raised fasting blood glucose and raised blood pressure estimates among other Asian migrants, compared with the native population aged 20-49 years who received health check-ups, in 2015

Variable	Age-adjusted prevalence (95% CI)*		*P* value
	Korean	Other Asian migrant	
Men, n	77,038	58,807	
Raised fasting blood glucose	3.8 (3.7–3.9)	3.1 (2.9–3.4)	< 0.0001
Raised blood pressure	9.1 (8.9–9.4)	5.7 (5.4–6.0)	< 0.0001
Women, n	59,074	4,321	
Raised fasting blood glucose	1.5 (1.4–1.6)	1.5 (1.1–1.9)	0.8655
Raised blood pressure	3.0 (2.9–3.1)	3.2 (2.6–3.9)	0.4628

* Data are expressed as %; age standardisation with 10-year age bands; the world standard population was used as the standard population; raised fasting blood glucose was defined as fasting blood glucose ≥ 126 mg/dL; raised blood pressure was defined as blood pressure ≥ 140/90 mm Hg.

With regard to age-specific prevalence, among participants aged 40-49 years, the prevalence of raised blood pressure in other Asian migrant women (8.0%) was higher than that in Korean women (6.2%) (Figure 25).

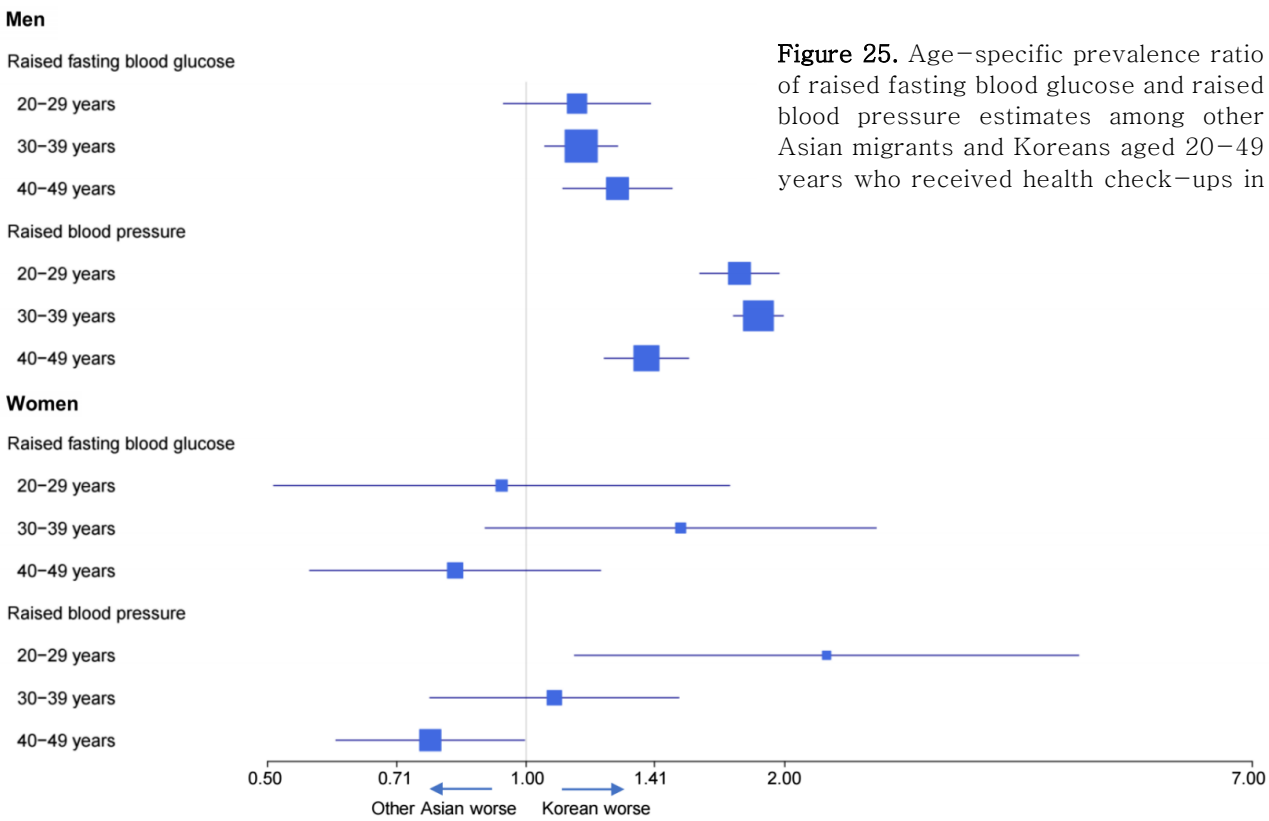


Figure 25. Age-specific prevalence ratio of raised fasting blood glucose and raised blood pressure estimates among other Asian migrants and Koreans aged 20-49 years who received health check-ups in

3.9 Incident type 2 diabetes and hypertension between Asian migrants and the native population

From 2009 to 2015, the number of participants who underwent health check-ups more than once and had diabetic information was 505,342. The number of participants with incident T2D between the first and last health check-up was 22,284. In the multivariable logistic regression model, Asian migrants were less likely to get T2D than Koreans (aOR, 0.82; 95% CI, 0.78 to 0.86) after adjustment for covariates. However, the aORs of developing T2D were 1.15 (95% CI, 1.10 to 1.20) among low-income level, 1.14 (95% CI, 1.10 to 1.18) among middle-low income level, and 1.09 (95% CI, 1.05 to 1.14) among high-middle income level, compared with high-income levels, regardless of whether they were Asian migrants or Koreans. In addition, older age, men, higher BMI, smoking status, alcohol consumption, and physical inactivity were also associated with an increasing risk of T2D (Table 22).

Table 22. Multivariable adjusted odds ratios of developing type 2 diabetes between the first and last health check-ups (N = 505,342)*

Variable	Adjusted odds Ratio (95% CI)
Type 2 diabetes	n = 22,284
Age (continuous, +1 year)	1.043 (1.042-1.044) †
Sex	
Men	1.44 (1.39-1.50) †
Women	1.00 (reference)
Nationality	
Asian Migrant	0.82 (0.78-0.86) †
Korean	1.00 (reference)

Economic status	
1st quartile (low)	1.15 (1.10–1.20) †
2nd quartile	1.14 (1.10–1.18) †
3rd quartile	1.09 (1.05–1.14) †
4th quartile (high)	1.00 (reference)
Body mass index (continuous, +1 kg/m^2)	1.159 (1.155–1.164) †
Smoking status	
Current−Smoker	1.00 (reference)
Ex−Smoker	0.79 (0.75–0.82) †
Non−Smoker	0.71 (0.68–0.74) †
Any alcohol use	
Yes	1.00 (reference)
No	0.96 (0.93–0.99) †
Physical activity	
Yes	1.00 (reference)
No	1.05 (1.02–1.08) †

* Adjusted odds ratios and 95% confidence intervals (CIs) of incident type 2 diabetes determinants were determined using the multivariable logistic regression model.

† $P < 0.05$.

Overall, compared with the native population, Chinese migrants (aOR, 0.81; 95% CI, 0.77 to 0.86), Japanese migrants (aOR, 0.67; 95% CI, 0.49 to 0.92), and other Asian migrants (aOR, 0.80; 95% CI, 0.74 to 0.86) were less likely to develop T2D after adjustment for covariates. However, among Vietnamese migrant men aged 20–39 years, the aOR of developing T2D was 1.32 (95% CI, 1.11–1.57) compared with Korean men (Table 23).

Table 23. Multivariable adjusted odds ratios of developing type 2 diabetes between the first and last health check–ups, according to nationality*

Variable	Adjusted odds Ratio (95% CI)					
	Native	Migrant				
	Korean	Chinese	Japanese	Filipino	Vietnamese	Other Asian
Total †	1.00 (reference)	0.81 (0.77–0.86)	0.67 (0.49–0.92)	0.97 (0.84–1.11)	0.98 (0.85–1.13)	0.80 (0.74–0.86)
Age (20–39years) ‡						
Men	1.00 (reference)	0.95 (0.84–1.07)	0.26 (0.07–1.06)	1.05 (0.89–1.24)	1.32 (1.11–1.57)	0.97 (0.88–1.08)
Women	1.00 (reference)	0.78 (0.57–1.06)	0.91 (0.22–3.72)	1.01 (0.57–1.79)	1.26 (0.68–2.35)	0.65 (0.38–1.10)
Age (≥ 40 years) ‡						
Men	1.00 (reference)	0.75 (0.69–0.81)	0.64 (0.39–1.04)	0.82 (0.51–1.31)	1.03 (0.41–2.56)	0.61 (0.45–0.81)
Women	1.00 (reference)	0.64 (0.57–0.72)	0.75 (0.47–1.20)	1.53 (0.56–4.21)	1.56 (0.73–3.35)	0.73 (0.37–1.42)

* Adjusted odds ratios and 95% confidence intervals (CIs) of incident type 2 diabetes determinants were determined using the multivariable logistic regression model.

† Adjusted for age (continuous, years), sex, economic status, BMI (continuous, kg/m^2), smoking status, any alcohol use, and physical activity.

‡ Adjusted for age (continuous, years), economic status, BMI (continuous, kg/m^2), smoking status, any alcohol use, and physical activity.

From 2009 to 2015, the number of participants who received health check-ups more than once and had hypertensive information was 431,433, and the number of participants with hypertension between the first and last health check-ups was 48,007. In the multivariable logistic regression model, Asian migrants were less likely to develop hypertension than Koreans (aOR, 0.77; 95% CI, 0.75-0.79) after adjustment for covariates. However, aORs for developing hypertension were 1.17 (95% CI, 1.13-1.21) in the low-income group, 1.17 (95% CI, 1.14-1.20) in the middle-low income group, and 1.15 (95% CI, 1.12-1.18) in the high-middle income group compared with those in the high-income levels, regardless of whether they were Asian migrants or Koreans. In addition, older age, men, higher BMI, smoking status, alcohol consumption, and physical inactivity were associated with an increasing risk of hypertension (Table 24).

Table 24. Multivariable adjusted odds ratios of developing hypertension between the first and last health check-ups (N = 431,433)*

Variable	Adjusted odds Ratio (95% CI)
Hypertension	n = 48,007
Age (continuous, +1 year)	1.059 (1.058-1.060) †
Sex	
Men	1.42 (1.38-1.46) †
Women	1.00 (reference)
Nationality	
Asian Migrant	0.77 (0.75-0.79) †
Korean	1.00 (reference)
Economic status	
1st quartile (low)	1.17 (1.13-1.21) †
2nd quartile	1.17 (1.14-1.20) †
3rd quartile	1.15 (1.12-1.18) †
4th quartile (high)	1.00 (reference)
Body mass index (continuous, +1 kg/m^2)	1.165 (1.161-1.169) †

Smoking status	
Current−Smoker	1.00 (reference)
Ex−Smoker	0.89 (0.86–0.92) †
Non−Smoker	0.95 (0.92–0.98) †
Any alcohol use	
Yes	1.00 (reference)
No	0.81 (0.79–0.83) †
Physical activity	
Yes	1.00 (reference)
No	1.05 (1.03–1.07) †

* Adjusted odds ratios and 95% confidence intervals (CIs) of incident hypertension determinants were determined using the multivariable logistic regression model.

† $P < 0.05$.

Overall, compared with the native population, Chinese migrants (aOR, 0.83; 95% CI, 0.80 to 0.86), Filipino migrants (aOR, 0.91; 95% CI, 0.83 to 0.99), Vietnamese migrants (aOR, 0.60; 95% CI, 0.53 to 0.67), and other Asian migrants (aOR, 0.64; 95% CI, 0.60 to 0.67) were less likely to develop hypertension after adjustment for covariates. However, compared with Korean women, the aORs of developing hypertension were 1.49 (95% CI, 1.05–2.11) and 2.22 (95% CI, 1.17–4.19) among Filipino migrant women aged 20−39 years and more than 40 years, respectively (Table 25).

Table 25. Multivariable adjusted odds ratios of developing hypertension between the first and last health check−ups, according to nationality*

Variable	Adjusted odds Ratio (95% CI)					
	Native	Migrant				
	Korean	Chinese	Japanese	Filipino	Vietnamese	Other Asian
Total †	1.00 (reference)	0.83 (0.80–0.86)	0.89 (0.74–1.07)	0.91 (0.83–0.99)	0.60 (0.53–0.67)	0.64 (0.60–0.67)
Age (20−39years) †						
Men	1.00 (reference)	0.70 (0.65–0.77)	0.58 (0.32–1.04)	0.76 (0.68–0.85)	0.55 (0.48–0.63)	0.55 (0.51–0.59)
Women	1.00 (reference)	0.72 (0.59–0.88)	0.83 (0.34–2.05)	1.49 (1.05–2.11)	0.79 (0.45–1.39)	1.04 (0.76–1.42)
Age (≥ 40 years) †						
Men	1.00 (reference)	0.85 (0.80–0.90)	0.73 (0.53–1.01)	0.82 (0.58–1.15)	0.42 (0.17–1.04)	0.70 (0.57–0.86)
Women	1.00 (reference)	0.78 (0.72–0.84)	1.16 (0.90–1.49)	2.22 (1.17–4.19)	0.78 (0.42–1.46)	0.97 (0.65–1.44)

* Adjusted odds ratios and 95% confidence intervals (CIs) of incident hypertension determinants were determined using the multivariable logistic regression model.

† Adjusted for age (continuous, years), sex, economic status, BMI (continuous, kg/m^2), smoking status, any alcohol use, and physical activity.

‡ Adjusted for age (continuous, years), economic status, BMI (continuous, kg/m^2), smoking status, any alcohol use, and physical activity.

3.10 The APC estimates of the age-adjusted prevalence of lifestyle factors and socioeconomic situation among Asian migrants and the native population

From 2009 to 2013, the age-adjusted prevalence of ex-smokers or current smokers increased among Asian migrant men (52.1% in 2009 and 55.1% in 2013, APC = 1.44, $P < 0.05$) compared with Korean men. However, the age-adjusted prevalence of ex-smokers or current smokers among Asian migrant men has decreased since 2013 (55.1% in 2013 and 53.9% in 2015, APC = −1.16, $P < 0.05$). In addition, the age-adjusted prevalence of any alcohol use increased among Korean men (from 69.6% in 2009 to 70.8% in 2015, APC = 0.29, $P < 0.05$) compared with Asian migrant men. Moreover, the age-adjusted prevalence of physical activity increased among Asian migrant men (from 44.4% in 2013 to 50.6% in 2015, APC = 6.68, $P < 0.05$) and Korean men (from 65.7% in 2009 to 74.2% in 2015, APC = 2.05, $P < 0.05$). Furthermore, the age-adjusted prevalence of low to middle income levels increased among Asian migrant men (from 94.7% in 2009 to 96.5% in 2015, APC = 0.31, $P < 0.05$) compared with Korean men. Among Korean men, the age-adjusted prevalence of low to middle income levels in 2009 and 2015 was 59.4% and 56.8%, respectively (Figure 26).

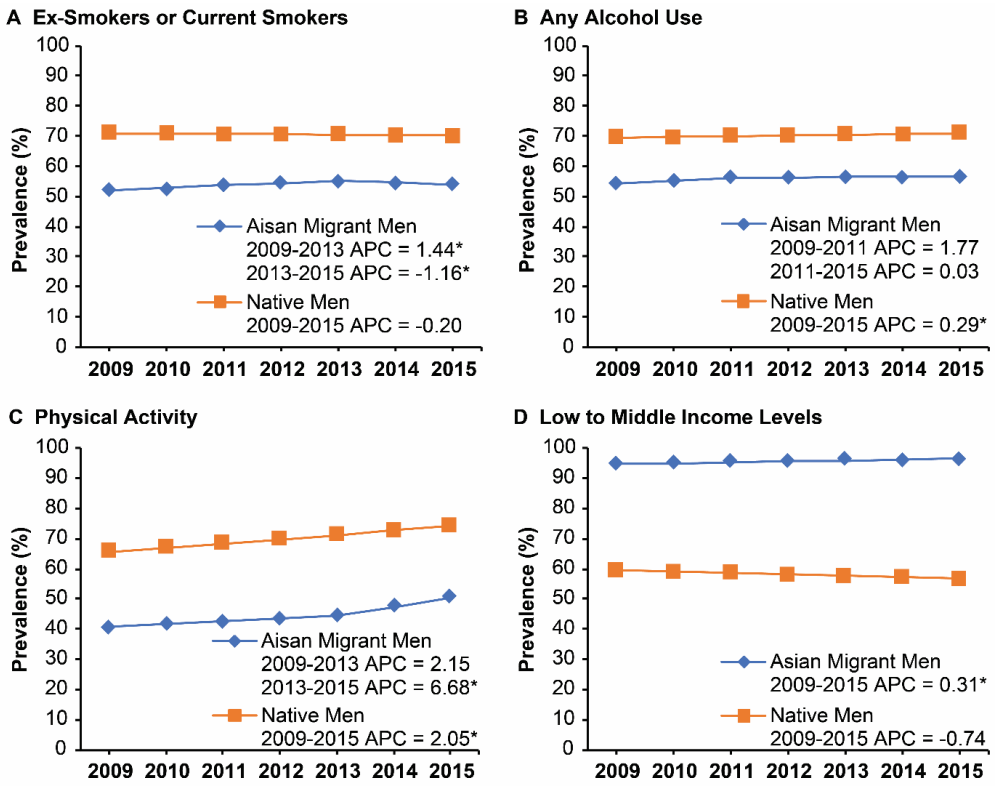


Figure 26. Age-adjusted prevalence of lifestyle factors and socioeconomic situation estimates among Asian migrant and Korean men†

The prevalence of lifestyle factors and socioeconomic situation was assessed in men aged 20 years and older, among Asian migrants and the native population from 2009 to 2015, in Korea. Lifestyle factors and socioeconomic situation estimates included (A) smoking, (B) alcohol, (C) physical activity, and (D) economic status.

* *P* value for the Annual Percentage Change (APC) < 0.05.

† The Korean mid-year population in 2005 was used as the standard population.

The age-adjusted prevalence of ex-smokers or current smokers among Asian migrant women has increased since 2011 (3.0% in 2011 to 3.9% in 2015, APC = 6.62, $P < 0.05$) compared with Korean women. In addition, the age-adjusted prevalence of any alcohol use increased among Asian migrant women (from 12.4% in 2009 to 17.8% in 2015, APC = 6.26, $P < 0.05$) and Korean women (from 28.8% in 2009 to 33.9% in 2015, APC = 2.79, $P < 0.05$). Moreover, the age-adjusted prevalence of physical activity increased among Asian migrant women (from 40.4% in 2009 to 50.3% in 2015, APC = 3.73, $P < 0.05$) and Korean women (from 58.2% in 2009 to 67.0% in 2015, APC = 2.37, $P < 0.05$). Furthermore, the age-adjusted prevalence of low to middle income levels increased among Asian migrant women (from 92.1% in 2009 to 95.0% in 2015, APC = 0.51, $P < 0.05$) compared with Korean women. Among Korean women, the age-adjusted prevalence of low to middle income levels in 2009 and 2015 was 69.3% and 69.1%, respectively (Figure 27).

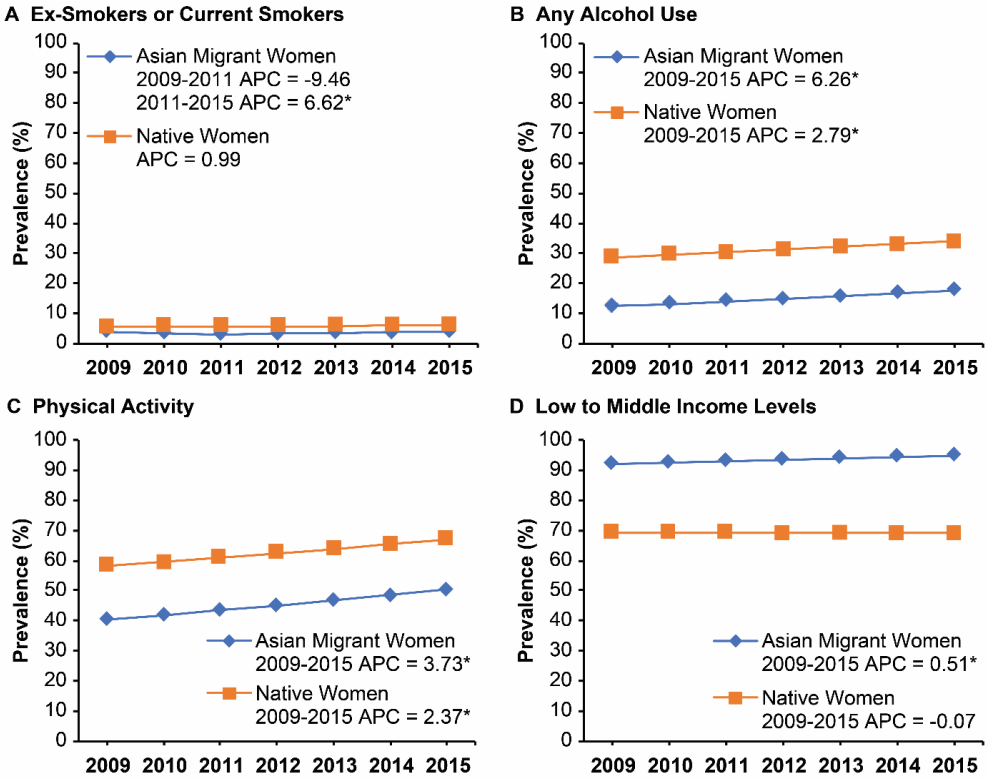


Figure 27. Age-adjusted prevalence of lifestyle factors and socioeconomic situation estimates among Asian migrant and Korean women †

The prevalence of lifestyle factors and socioeconomic situation was assessed in women aged 20 years and older, among Asian migrants and the native population from 2009 to 2015, in Korea. Lifestyle factors and socioeconomic situation estimates included (A) smoking, (B) alcohol, (C) physical activity, and (D) economic status.

* *P* value for the Annual Percentage Change (APC) < 0.05.

† The Korean mid-year population in 2005 was used as the standard population.

3.11 The APC estimates of the age-adjusted prevalence of health status among Asian migrants and the native population

The age-adjusted prevalence of diabetes increased among Korean men (from 8.8% in 2009 to 9.7% in 2015, APC = 1.64, $P < 0.05$) compared with Asian migrant men. However, the age-adjusted prevalence of hypertension decreased among Asian migrant men (from 18.6% in 2009 to 17.4% in 2015, APC = −1.12, $P < 0.05$) compared with Korean men. In addition, the age-adjusted prevalence of hypercholesterolemia increased among Korean men (from 10.0% in 2009 to 11.2% in 2015, APC = 1.82, $P < 0.05$), compared with Asian migrant men. Moreover, increasing prevalence trends of obesity were shown among Asian migrant men (from 27.9% in 2009 to 28.9% in 2013, APC = 0.89, $P < 0.05$; from 28.9% in 2013 to 31.7% in 2015, APC = 4.70, $P < 0.05$) and Korean men (from 37.9% in 2009 to 40.0% in 2013, APC = 1.37, $P < 0.05$; from 40.0% in 2013 to 43.1% in 2015, APC = 3.74, $P < 0.05$) (Figure 28).

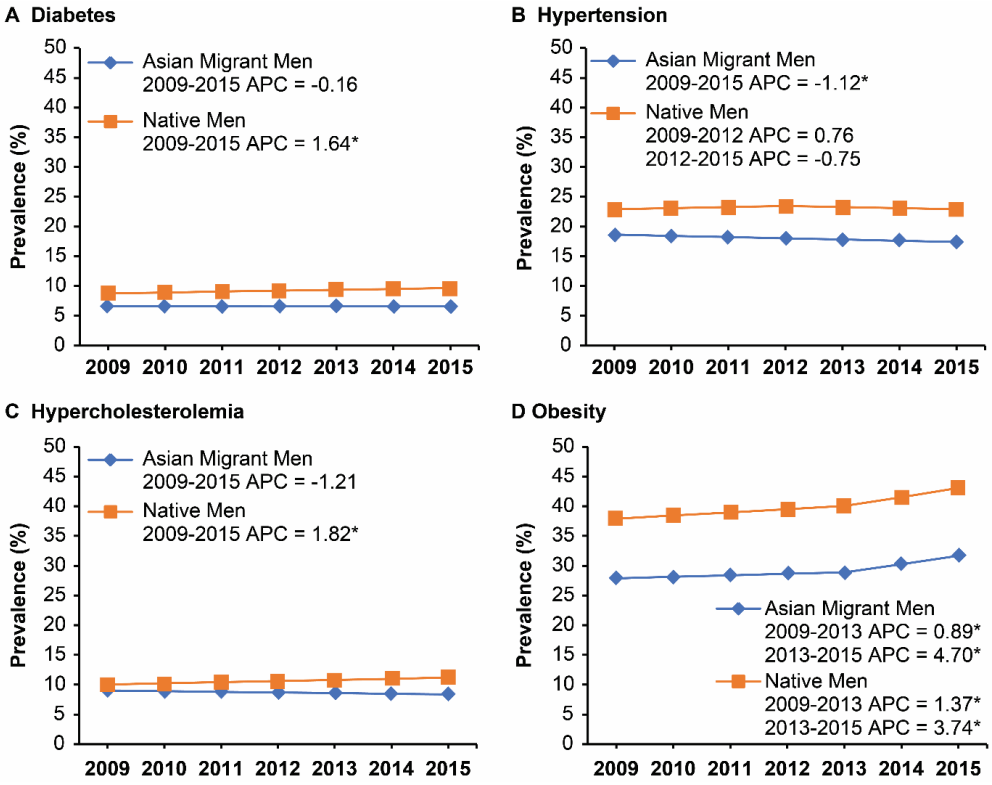


Figure 28. Age-adjusted prevalence of health status estimates among Asian migrant and Korean men†

The prevalence of the health status was assessed in men aged 20 years and older, among Asian migrants and the native population from 2009 to 2015, in Korea. Health status estimates included (A) diabetes, (B) hypertension, (C) hypercholesterolemia, and (D) obesity.

* *P* value for the Annual Percentage Change (APC) < 0.05.

† The Korean mid-year population in 2005 was used as the standard population.

The age-adjusted prevalence of diabetes increased among Korean women (from 6.0% in 2009 to 6.7% in 2015, APC = 1.88, $P < 0.05$) compared with Asian migrant women. However, the age-adjusted prevalence of hypertension decreased among Asian migrant women (from 16.7% in 2009 to 15.3% in 2015, APC = −1.42, $P < 0.05$) compared with Korean women. In addition, increasing prevalence trends of obesity were shown among Asian migrant women (from 22.5% in 2009 to 25.2% in 2015, APC = 1.92, $P < 0.05$), compared with Korean women (from 23.9% in 2009 to 24.3% in 2015, APC = 0.31, P = 0.4). Moreover, the age-adjusted prevalence of obesity among Asian migrant and Korean women in 2014 was 24.7% and 24.2%, respectively (Figure 29).

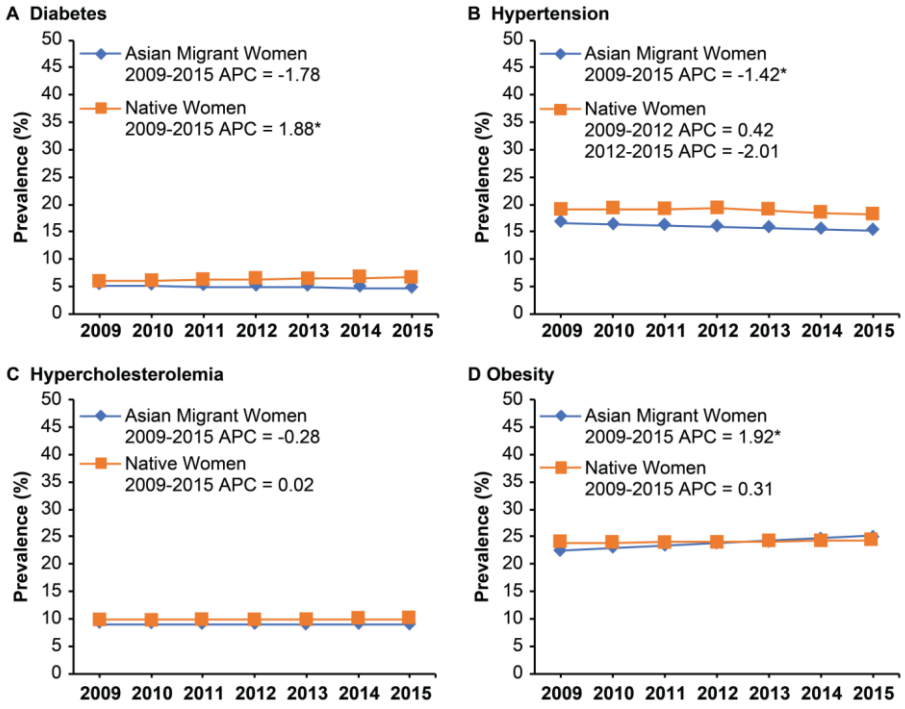


Figure 29. Age-adjusted prevalence of health status estimates among Asian migrant and Korean women †

The prevalence of the health status was assessed in women aged 20 years and older, among Asian migrants and the native population from 2009 to 2015, in Korea. Health status estimates included (A) diabetes, (B) hypertension, (C) hypercholesterolemia, and (D) obesity.

* *P* value for the Annual Percentage Change (APC) < 0.05.

† The Korean mid-year population in 2005 was used as the standard population.

3.12 Health of Asian migrants in Korea, compared with the general population in the home countries

3.12.1 Chinese migrants in Korea versus the general population in China

In 2015, the age-adjusted prevalence of obesity and raised blood pressure among Chinese migrants in Korea were lower than that among the general population in China, respectively. In addition, in 2014, the age-adjusted prevalence of diabetes among Chinese migrants in Korea was lower than that among the general population in China (Table 26)

Table 26. Age-adjusted prevalence of obesity, raised blood pressure, and diabetes among Chinese migrants in Korea and the general population in China

Variable	Chinese migrants in Korea*	General population in China †
Total		
Obesity (%)	30.6	37.5
Raised blood pressure (%)	11.2	19.2
Diabetes (%)	6.0	8.8
Men		
Obesity (%)	35.6	39
Raised blood pressure (%)	14.2	21.5
Diabetes (%)	7.4	9.9
Women		
Obesity (%)	25.6	35.7
Raised blood pressure (%)	8.2	16.8
Diabetes (%)	4.5	7.6

* Data are expressed as %; age standardisation with 10-year age bands; the world standard population was used as the standard population; obesity was defined as a BMI ≥ 25 kg/m^2 for the Asian population; raised blood pressure was defined as blood pressure ≥ 140/90 mm Hg; diabetes was defined as a fasting blood glucose ≥ 126 mg/dL, previous diabetes diagnosis, or prescription of antidiabetic drugs; with regard to obesity and raised blood pressure, we used the data in 2015; with regard to diabetes, we used the data in 2014.
† Source: data from the Global Health Observatory data repository of the World Health Organization. Available from: http://apps.who.int/gho/data/node.mai

n.A867?lang=en/.

3.12.2 Japanese migrants in Korea versus the general population in Japan

In 2015, the age-adjusted prevalence of obesity and raised blood pressure among Japanese migrants in Korea were lower than that among the general population in Japan, respectively. However, the age-adjusted prevalence of obesity among Japanese migrant men was similar to that among men from the general population in Japan. In addition, in 2014, the age-adjusted prevalence of diabetes among Japanese migrants in Korea was lower than that among the general population in Japan (Table 27).

Table 27. Age-adjusted prevalence of obesity, raised blood pressure, and diabetes among Japanese migrants in Korea and the general population in Japan

Variable	Japanese migrants in Korea*	General population in Japan†
Total		
Obesity (%)	25.2	30.9
Raised blood pressure (%)	8.6	17.6
Diabetes (%)	5.7	6.7
Men		
Obesity (%)	36.1	36.5
Raised blood pressure (%)	11.4	22.5
Diabetes (%)	7.5	8.4
Women		
Obesity (%)	19.2	25.2
Raised blood pressure (%)	5.8	12.6
Diabetes (%)	4.0	5.0

* Data are expressed as %; age standardisation while age groups consist of those 20-44, 45-64, and ≥ 65 years; the world standard population was used as the standard population; obesity was defined as a BMI ≥ 25 kg/m^2 for the Asian population; raised blood pressure was defined as blood pressure ≥ 140/90 mm Hg; diabetes was defined as a fasting blood glucose ≥ 126 mg/dL, previous diabetes diagnosis, or prescription of antidiabetic drugs; with regard to obesity and raised blood pressure, we used the data in 2015; with regard to diabetes, we used the data in 2014.

† Source: data from the Global Health Observatory data repository of the World Health Organization. Available from: http://apps.who.int/gho/data/node.main.A867?lang=en/.

3.12.3 Filipino migrants in Korea versus the general population in the Philippines

In 2015, the age-adjusted prevalence of raised blood pressure among Filipino migrants in Korea was lower than that among the general population in the Philippines. However, the age-adjusted prevalence of obesity (41.4%) in Filipino migrant men was higher than that (30.4%) in men from the general population in the Philippines. In addition, in 2014, the age-adjusted prevalence of diabetes (12.5%) in Filipino migrant men was higher than that (7.1%) in men from the general population in the Philippines (Table 28).

Table 28. Age-adjusted prevalence of obesity, raised blood pressure, and diabetes among Filipino migrants in Korea and the general population in the Philippines

Variable	Filipino migrants in Korea*	General population in the Philippines†
Total		
Obesity (%)	36.2	33.2
Raised blood pressure (%)	10.0	22.6
Diabetes (%)	8.7	7.2
Men		
Obesity (%)	41.4	30.4
Raised blood pressure (%)	9.3	24.1
Diabetes (%)	12.5	7.1
Women		
Obesity (%)	30.9	35.5
Raised blood pressure (%)	10.6	21
Diabetes (%)	4.9	7.3

* Data are expressed as %; age standardisation with 10-year age bands; the world standard population was used as the standard population; obesity was defined as a BMI ≥ 25 kg/m^2 for the Asian population; raised blood pressure was defined as blood pressure ≥ 140/90 mm Hg; diabetes was defined as a fasting blood glucose ≥ 126 mg/dL, previous diabetes diagnosis, or prescription of antidiabetic drugs; with regard to obesity and raised blood pressure, we used the data in 2015; with regard to diabetes, we used the data in 2014.

† Source: data from the Global Health Observatory data repository of the World Health Organization. Available from: http://apps.who.int/gho/data/node.main.A867?lang=en/.

3.12.4 Vietnamese migrants in Korea versus the general population in Vietnam

In 2015, the age-adjusted prevalence of obesity and raised blood pressure among Vietnamese migrants in Korea were lower than that among the general population in Vietnam, respectively. However, in 2014, the age-adjusted prevalence of diabetes among Vietnamese migrant women was similar to that among women from the general population in Vietnam (Table 29).

Table 29. Age-adjusted prevalence of obesity, raised blood pressure, and diabetes among Vietnamese migrants in Korea and the general population in Vietnam

Variable	Vietnamese migrants in Korea*	General population in Vietnam †
Total		
Obesity (%)	13.1	33.2
Raised blood pressure (%)	6.9	23.4
Diabetes (%)	4.5	5.3
Men		
Obesity (%)	13.5	30.4
Raised blood pressure (%)	6.9	25.0
Diabetes (%)	3.9	5.5
Women		
Obesity (%)	12.7	35.5
Raised blood pressure (%)	7.0	21.6
Diabetes (%)	5.0	5.1

* Data are expressed as %; age standardisation with 10-year age bands; the world standard population was used as the standard population; obesity was defined as a BMI ≥ 25 kg/m^2 for the Asian population; raised blood pressure was defined as blood pressure ≥ 140/90 mm Hg; diabetes was defined as a fasting blood glucose ≥ 126 mg/dL, previous diabetes diagnosis, or prescription of antidiabetic drugs; with regard to obesity and raised blood pressure, we used the data in 2015; with regard to diabetes, we used the data in 2014.
† Source: data from the Global Health Observatory data repository of the World Health Organization. Available from: http://apps.who.int/gho/data/node.main.A867?lang=en/.

4 Discussion

The results of the current study demonstrate that an overall health advantage exists in terms of cardiovascular risk factors, especially diabetes and hypertension, among Chinese and Japanese migrants in 2015. However, the health advantage disappears among Filipino, Vietnamese, and other Asian migrants, especially migrant women. Specifically, among participants aged 30–39 years, the prevalence of diabetes in Chinese migrant men was higher than that in Korean men; and among participants 40–49 years, the prevalence of hypertension in Chinese migrant women was higher than that in Korean women. Among Filipino migrants aged 20–49 years, the age−adjusted prevalence of diabetes and hypertension in Filipino migrant women was higher than that in Korean women in 2015. Furthermore, Asian migrants were less likely to have T2D and hypertension than the native population between 2009−2015. However, in the multivariate analyses, among participants aged 20–39 years, Vietnamese migrant men were more likely to have T2D than Korean men; and among participants aged ≥ 20 years, Filipino migrant women were more likely to have hypertension than Korean women after adjusting for covariates. Compared with the general population in the home countries, we found that the majority of Asian migrants had a lower prevalence of obesity, diabetes, and raised blood

pressure in Korea. However, a higher prevalence of obesity and diabetes was observed in Filipino migrant men than in the general population in the Philippines.

4.1. A comparison of prevalence of cardiovascular risk factors between Asian migrants and the native population in 2015

In 2015, among participants aged ≥ 20 years, the age-adjusted prevalence of any alcohol use, ex-smokers or current smokers, diabetes, hypertension, and hypercholesterolemia were lower among Asian migrants than the native population in Korea, regardless of whether they were male or female. Although obesity was more common among Asian migrant women compared with Korean women, however, we estimated that the majority of Asian migrants were healthier than the native population in Korea (22).

Among migrants, unhealthy diets, physical inactivity, low socioeconomic status, genetics, and genetic-environmental interactions may result in obesity, diabetes, and hypertension (13, 32-34). Moreover, obesity is one of the major health concerns among migrants, especially migrant women (35). However, we could not determine a clear concurrence pattern between obesity and diabetes among Asian migrants compared with the native population of Korea. This is consistent with

previous research that showed that there was no concurrence pattern between obesity and T2D in international migrants from the Western Pacific region to Europe, including Chinese and Vietnamese migrants (35). In 2015, the age-adjusted prevalence of current smokers, physical inactivity, and low-income level were higher in Chinese migrant men than in Korean men. Specifically, among participants aged 30–39 years, the prevalence of diabetes in Chinese migrant men was higher than that in Korean men. Moreover, we found a notable concurrent pattern between low-income level and diabetes among Chinese migrant men aged 30–39 years, compared with Koreans. In addition, the prevalence ratio of low-income level ranked highest among Chinese migrant men aged 30–39 years compared with Korean men, or even other age groups of Chinese migrant men. Therefore, a low-income level may be one of the most important factors contributing to increased diabetes in Chinese migrant men aged 30–39 years compared with Koreans (13, 32-34).

In 2015, the age-adjusted prevalence of obesity, physical inactivity, and low-income level were higher in Chinese migrant women than in Korean women. Specifically, among participants 40–49 years, the prevalence of hypertension in Chinese migrant women was higher than that in Korean women. However, there was only a clear concurrence pattern between obesity and

hypertension in participants aged 40–49 years among Chinese migrant women, compared with Korean women. In our study, the age-adjusted prevalence of raised blood pressure in Chinese migrants was higher than that in Koreans in 2015. A meta-analytic review showed that an important association exists between acculturation to Western society and higher blood pressures, and the association was more influential than an unhealthy diet or physical inactivity (36). In addition, the stress of cultural changes appears to be a major burden among migrants (36). We speculate that Chinese migrants aged 40–49 years confront more stress and cultural conflicts in the process of acculturation to social environments in Korea. Therefore, acculturation to a new society in Korea can explain the higher prevalence of raised blood pressure in Chinese migrants compared with Koreans in the 40–49 years age group. Moreover, stress and obesity may be major factors contributing to hypertension among Chinese migrant women aged 40–49 years compared with Korean women (13, 37-39).

Overall, among Filipino migrants aged ≥ 20 years, the frequency of low-income level and physical inactivity was greater than that among Koreans in 2015. In addition, the age-adjusted prevalence of obesity in Filipino migrant women was higher than that in Korean women. However, among participants

20–49 years, the age–adjusted prevalence of obesity, diabetes, and hypertension in Filipino migrant women was higher than that in Korean women. Among Filipino migrant women aged 20–49 years, we found a clear concurrence pattern between obesity and diabetes/hypertension compared with Korean women, which may result from an unhealthy diet, physical inactivity, early life factors, poor adherence to medical therapy, low socioeconomic status, genetics, and genetic–environmental interactions (13, 32–34). Moreover, among Filipino migrant women aged 20–49 years, the increased prevalence of hypertension may result from the stress associated with acculturation, which seems to be a major problem (36, 39).

Interestingly, among participants aged 30–39 years, Chinese migrant men had a greater prevalence of diabetes than Korean men, whereas Filipino migrant women had a greater prevalence of diabetes than Korean women. Therefore, we speculate that the migrant age group of 30–39 years seems to be more susceptible to diabetes among several migrant–related lifestyle changes (13, 32–34).

4.2. Incident type 2 diabetes and hypertension between Asian migrants and the native population

From 2009–2015, Asian migrants were less likely to have T2D

and hypertension than the native population in our study. However, among participants aged 20–39 years, Vietnamese migrant men were more likely to have T2D than Koreans, after adjusting for covariates. This finding among Vietnamese migrant men aged 20–39 years is consistent with the results of a previous study that showed that international migrants developed diabetes 10–20 years earlier than the native population of host countries (13, 40, 41).

Increasing evidence suggests that genetic factors, epigenetic factors, and lifestyle factors interact and work in a larger physical, social, and cultural environment. These factors can play an important role in the pathophysiology of T2D, particularly in Asians (42). Although clinical parameters such as BMI, age, fasting blood glucose levels, and dyslipidaemia, are important predictors for T2D, inherent genetic variation might also play a role in the pathogenesis of the disease (42). Even though the BMI of Asian migrants in the United States is lower than that of the Americans, they are more likely to have T2D than Caucasians (43). This could be due to the difference in fat distribution, body fat percentage, and abdominal obesity between Asians and Caucasians (44–46). However, in this large-scale longitudinal study, after adjusting for covariates, Asian migrants were found to be less likely to develop T2D than Koreans. Other factors like

an older age, the male sex, lower income levels, a higher BMI, smoking status, alcohol consumption, and lack of physical activity were related to the likelihood of developing T2D, regardless of whether they were Asian migrants or Koreans.

The pathophysiology of T2D is characterised by β-cell dysfunction and insulin resistance, and genetic variants only play a modest role (47, 48). However, if gene-environment interactions are taken into consideration, Koreans might have a slightly stronger genetic predisposition towards T2D than the majority of Asian migrants. Therefore, the susceptibility to T2D in Koreans might be higher than that in the majority of Asian migrants in Korea. According to a recent study, medium or high genetic risk scores for impaired insulin secretion due to β-cell dysfunction were up to 72% in Koreans, and the interaction between genetic factors and a low-carbohydrate Western-style diet exacerbated the likelihood of developing T2D (49). Moreover, Koreans have drastically changed their eating habits in the past 20 to 30 years (50). Therefore, we explain the greater susceptibility to T2D in Koreans than the majority of Asian migrants within the gene-environment interaction by the thrifty phenotype hypothesis, due to a mismatch of nutritional environments between early life and adulthood (42). According to the thrifty phenotype hypothesis, the likelihood of developing

T2D, and even transgenerational risk transmission via an epigenetic process, is associated with permanent changes like impaired insulin secretion and insulin resistance that occurred due to poor fetal nutrition (51, 52).

In our study, after adjusting for covariates, Asian migrants were less likely to have hypertension than the native population of Korea. Moreover, we also found that the likelihood of developing hypertension was associated with an older age, the male sex, lower income levels, a higher BMI, smoking status, alcohol consumption, and physical inactivity regardless of whether they were Asian migrants or Koreans. However, considering the important relationship between the stress of cultural changes and increased blood pressure among migrants (36, 39), the reason most Asian migrants were less likely to develop hypertension than Koreans may be that with similar cultures and a relatively close geographic location to their home country, Asian migrants in Korea are more likely to adapt to social environments of the host country and maintain large social networks and ensure sufficient social support. We speculate that these factors may help Asian migrants in Korea reduce stress and deal with conflicts easier during the process of acculturation to a different society.

Overall, Chinese migrants were less likely to have

hypertension and were generally healthier than Koreans. Moreover, according to the 2015 Ministry of Justice statistics, 50.3% of Chinese migrants are Korean-Chinese, so we speculate that they can communicate easily and adapt better to Korean culture and society (4). However, although the prevalence of hypertension in Chinese migrants was lower than Koreans, increased blood pressure was more prevalent than in Koreans. Although Chinese migrants were less likely to get hypertension, hypertension management among Chinese migrants may be worse than Koreans. Interestingly, in the multivariate analyses, Filipino migrant women were more likely to have hypertension than Korean women. This further demonstrates the role of cultural factors in the process of developing hypertension among Filipino migrant women (36, 39).

4.3. Time series analysis through Joinpoint regression

In Korea, for both men and women, the age-adjusted prevalence of diabetes among Asian migrants showed stable trends from 2009 to 2015 when compared with Koreans. According to a recent systematic review and meta-analysis on migrant health, migration from low-income and middle-income countries to high-income countries led to lower mortality due to diabetes in the migrants than in the native-born population of the home

countries (3). However, in Denmark, international migrants from Africa, Asia, and the Middle East were found to have higher prevalence, incidence, and annual increasing mortality rates due to diabetes when compared with the native-born Danes (53).

Thus, our study showed that in both men and women, incident T2D in Asian migrants was associated with lower income, physical inactivity, and increased obesity, compared with Koreans. In Asian migrant women, incident T2D was also associated with a higher annual increase in age-adjusted prevalence of being an ex-smoker or current smoker as well as with alcohol consumption. The age-adjusted prevalence of low to middle income levels was much higher among Asian migrants compared with Koreans and showed a higher annual increase. This may lead to more serious health inequalities concerning T2D among most Asian migrants compared with Koreans, especially targeting low-income migrants. It was found that from 2009 to 2015, physical inactivity among Asian migrants was much higher than that among Koreans. Moreover, during the period from 2013 to 2015, an increase in the age-adjusted prevalence of obesity was found among Asian migrant men compared with Korean men. A higher annual increase in the age-adjusted prevalence of obesity among Asian migrant women compared with Korean women was observed from 2009 to 2015,

and this trend was found to be on the decline since 2014. Furthermore, from 2011 to 2015, an annual increase in the age-adjusted prevalence of ex-smokers or current smokers was demonstrated, and a higher annual increase in the age-adjusted alcohol consumption was observed among Asian migrant women compared with Korean women during the period from 2009 to 2015. Therefore, among the majority of Asian migrants, especially low-income migrants and migrant women, primary and secondary prevention of T2D is necessary.

Interestingly, we found that the age-adjusted prevalence of hypertension in Asian migrants showed decreasing trends from 2009 to 2015 compared with that in Koreans in both men and women. This prevalence trends of hypertension which have remained unchanged among Koreans over the recent years are consistent with the previous study in Korea (54). In addition, although Asian migrants were less likely to have hypertension than Koreans, the same problems related to incident hypertension also existed as incident T2D in Asian migrants because the risk of having hypertension was associated with socioeconomic situation and lifestyle factors. Therefore, it is necessary to conduct a primary and secondary prevention program for hypertension among the majority of Asian migrants, especially targeting low-income migrants and migrant women.

4.4. Health of Asian migrants in Korea, compared with the general population in the home countries

In 2015, compared with the general population in the home countries, overall, we found that the majority of Asian migrants in Korea were healthier in obesity, diabetes, and raised blood pressure. However, compared with the general population in the Philippines, a higher prevalence of obesity and diabetes was observed in Filipino migrant men. An expert review of non-communicable diseases targeting migrants speculated that an unhealthy diet, physical inactivity, low socioeconomic status, genetics, and genetic-environmental interactions may result in obesity and diabetes among Filipino migrant men in Korea (13, 32-34).

4.5. Healthy migrant hypotheses and implications for clinicians and policymakers

During 2009-2015, the age-adjusted prevalence of diabetes, hypertension, and hypercholesterolemia was lower among most Asian migrants than among the native population of Korea, regardless of sex (22). Although obesity has become more frequent in Asian migrant women than in Korean women since 2004, we estimated that most Asian migrants were healthier than the native population of Korea (22). Compared with the general

populations in their home countries, we found that the majority of Asian migrants in Korea were healthier, in terms of the prevalence of obesity, diabetes, and raised blood pressure. Therefore, this study explains the healthy migrant hypothesis th rough self-selection and immigration policies (8-11, 22). However, given the findings of this study and previous studies, we speculated that the healthy migrant effect gradually disappears, especially considering the increasing trends of obesity among Asian migrant men and women in Korea (5, 7, 12, 22).

With regard to Chinese migrants, in 2015, among participants aged ≥ 20 years, the age-adjusted prevalence of current smokers was higher in Chinese migrant men than in Korean men, whereas the age-adjusted prevalence of obesity was higher in Chinese migrant women than in Korean women. In addition, the age-adjusted prevalence of physical inactivity was higher in Chinese migrants than in Koreans. However, for both sexes, the age-adjusted prevalence of diabetes, hypertension, and hypercholesterolemia was higher in Koreans than in Chinese migrants. In general, we estimated that a health advantage exists among Chinese migrants in our study (7-9).

With regard to Japanese migrants, in 2015, among participants aged ≥ 20 years, the age-adjusted prevalence of current

smokers in Japanese migrant women was similar to that in Korean women. In addition, the age-adjusted prevalence of physical inactivity in Japanese migrants was similar to that in Koreans. However, the age-adjusted prevalence of hypercholesterolemia was higher in Japanese migrants than in Koreans. However, for both sexes, the age-adjusted prevalence of obesity, diabetes, and hypertension was higher in Koreans than in Japanese migrants. In general, we estimated that a health advantage exists among Japanese migrants in our study (7-9).

With regard to Filipino migrants, in 2015, among participants aged ≥ 20 years, the age-adjusted prevalence of current smokers was lower in Filipino migrants than in Koreans, whereas the age-adjusted prevalence of physical inactivity was higher in Filipino migrants than in Koreans. In addition, the age-adjusted prevalence of obesity was higher in Filipino migrant women than in Korean women. Moreover, for both sexes, the age-adjusted prevalence of diabetes, hypertension, and hypercholesterolemia in Filipino migrants was similar to that in Koreans. In general, given the findings of this study and previous studies, we estimated that a health advantage does not exist among Filipino migrants in our study (5, 7, 12).

With regard to Vietnamese migrants, in 2015, among participants aged ≥ 20 years, the age-adjusted prevalence of

current smokers was lower in Vietnamese migrants than in Koreans, whereas the age-adjusted prevalence of physical inactivity was higher in Vietnamese migrants than in Koreans. Additionally, the age-adjusted prevalence of obesity and hypertension was lower in Vietnamese migrants than in Koreans. However, the age-adjusted prevalence of diabetes in Vietnamese migrant women was similar to that in Korean women. Lastly, for both sexes, the age-adjusted prevalence of hypercholesterolemia was higher in Vietnamese migrants than in Koreans. In general, given the findings of this study and previous studies, we estimated that any health advantage was gradually disappearing among Vietnamese migrants, especially Vietnamese migrant women, in our study (5, 7, 12).

With regard to other Asian migrants, in 2015, among participants aged ≥ 20 years, the age-adjusted prevalence of current smokers and obesity was higher in other Asian migrant women than in Korean women. In addition, the age-adjusted prevalence of physical inactivity was higher in other Asian migrants than in Koreans. Moreover, the age-adjusted prevalence of diabetes and hypertension in other Asian migrant women was similar to that in Korean women. Furthermore, for both sexes, the age-adjusted prevalence of hypercholesterolemia in other Asian migrants was similar to that

in Koreans. In general, given the findings of this study and previous studies, we estimated that any health advantage was disappearing among other Asian migrants, especially other Asian migrant women, in our study (5, 7, 12).

In summary, in 2015, an overall health advantage existed in terms of cardiovascular risk factors, especially diabetes and hypertension, among Chinese and Japanese migrants. However, for both sexes, the age-adjusted prevalence of diabetes and hypertension in Filipino migrants was similar to that in Koreans. The age-adjusted prevalence of diabetes in Vietnamese migrant women was similar to that in Korean women, whereas the age-adjusted prevalence of diabetes and hypertension in other Asian migrant women was similar to that in Korean women. In addition, in the multivariate analyses, from 2009 to 2015, Filipino migrant women were more likely to develop hypertension than Korean women. Among participants aged 20–39 years, Vietnamese migrant men were more likely to develop T2D than Korean men. Furthermore, the age-adjusted prevalence of low-income level among Asian migrants was higher, especially targeting Filipino, Vietnamese and other Asian migrant women, than that among Koreans; and as the age-adjusted prevalence of low-income level in Filipino, Vietnamese and other Asian migrants ranked higher than that in Chinese and Japanese migrants, we speculate

that more health inequalities exist in other Asian migrants, similar to Filipino and Vietnamese migrants, especially in migrant women (3, 22). Therefore, health advantages might disappear among Filipino, Vietnamese, and other Asian migrants, especially migrant women.

4.6. Strengths and limitations of this study

Our study has several strengths. First, it was a large-scale ecological study that analysed the prevalence of cardiovascular risk factors among international migrants compared with the host population in Asia, using big data. Second, we examined the differences according to nationality in incident T2D and hypertension between Asian migrants and the native population in Korea, using longitudinal data collection. Third, we investigated the differences in obesity, diabetes, and a raised blood pressure between Asian migrants in Korea and the general populations in their home countries, using direct standardisation with the world standard population.

Our study has several limitations. First, as we only selected people who had national health insurance and underwent health check-ups, the total cases of diabetes and hypertension was underestimated. In addition, the study population may have been healthier than the entire population if they were more concerned about their health and more likely to utilise healthcare and

medical services. However, the trends in the prevalence of diabetes among Korean men and women aged ≥ 20 years increased from 2009 to 2015 in the health check-up database of the NHID, which is consistent with the results of a recent study targeting Korean adults aged ≥ 30 years based on the Korean National Health and Nutrition Examination Surveys (22, 55). Among Korean men and women aged ≥ 30 years, the prevalence of diabetes in the health check-up database of the NHID in 2015 was 12.3% and 7.6%, respectively, which is similar to the prevalence of diabetes using the Korean National Health and Nutrition Examination Survey data of 2009–2013 (11.4% and 8.7%, respectively) (22, 55). Moreover, underestimation of diabetes and hypertension may be more frequent among Asian migrants than among Koreans in our study (22). For example, in Singapore, although international migrant workers have national health insurance when employed, they may not make full use of necessary health services or even know that they are covered (56). Second, we did not consider family history, nutritional factors, stress, and depression; for this reason, the association between these factors and incident T2D or hypertension could not be determined. Third, owing to limited data on the type of migrant, we did not consider migrant status factors; however, we substituted economic status for migrant status in an effort to compensate (22).

5 Summary and conclusion

The results of the current study demonstrate that an overall health advantage exists in terms of cardiovascular risk factors, especially with regard to diabetes and hypertension among Chinese and Japanese migrants in 2015. However, the health advantage disappears among Filipino, Vietnamese, and other Asian migrants, especially migrant women. Specifically, among participants aged 30–39 years, the prevalence of diabetes in Chinese migrant men was higher than that in Korean men; and among participants aged 40–49 years, the prevalence of hypertension in Chinese migrant women was higher than that in Korean women. Among Filipino migrants aged 20–49 years, the age−adjusted prevalence of diabetes and hypertension in Filipino migrant women was higher than that in Korean women in 2015.

Overall, Asian migrants were less likely to have T2D and hypertension than the native population from 2009–2015. Moreover, we also found that the likelihood of developing T2D and hypertension were associated with older age, men, lower income levels, higher BMI, smoking status, alcohol consumption, and physical inactivity regardless of whether they were Asian migrants or Koreans. However, in the multivariate analyses, among participants aged 20–39 years, Vietnamese migrant men were more likely to have T2D than Korean men; and among

participants aged ≥ 20 years, Filipino migrant women were more likely to have hypertension than Korean women after adjustment for covariates.

In Korea, from 2009 to 2015, the age-adjusted prevalence of diabetes increased among Korean men compared with Asian migrant men, and the age-adjusted prevalence of diabetes increased among Korean women compared with Asian migrant women. However, the age-adjusted prevalence of hypertension decreased among Asian migrant men compared with that among Korean men, and the age-adjusted prevalence of hypertension decreased among Asian migrant women compared with that among Korean women. In addition, we found that the age-adjusted prevalence of low to middle income levels were much greater, and increased, among Asian migrants compared with Koreans. Moreover, from 2009 to 2015, increasing prevalence trends of obesity were shown among Asian migrants, compared with Koreans. Furthermore, in both men and women, the problems of lower income, physical inactivity, and increasing obesity were associated with incident T2D and hypertensions in Asian migrants compared with the native population.

Compared with the general population in the home countries, we found that the majority of Asian migrants had a lower prevalence of obesity, diabetes and raised blood pressure in

Korea. However, a higher prevalence of obesity and diabetes was observed in Filipino migrant men than that in the general population in the Philippines. We speculate that unhealthy diet, physical inactivity, low socioeconomic status, genetics, and genetic–environmental interactions may result in obesity and diabetes among Filipino migrant men in Korea.

From 2009–2015, we found that the age–adjusted prevalence of diabetes, hypertension, hypercholesterolemia were lower among the majority of Asian migrants than the native population in Korea, regardless of whether they were male or female. Although most of the Asian migrants also had less obesity than Koreans from 2009 to 2015, since 2014, obesity has become more common among Asian migrant women compared with native women. However, we estimated that the majority of Asian migrants were healthier than the native population in Korea. More specifically, an overall health advantage exists in terms of cardiovascular risk factors, especially with regard to diabetes and hypertension among Chinese and Japanese migrants in our study. However, the health advantage disappears among Filipino, Vietnamese, and other Asian migrants, especially migrant women. Compared with the general population in the home countries, we found that the majority of Asian migrants in Korea were healthier, as defined by the prevalence of obesity, diabetes, and raised

blood pressure. Therefore, this study supports the healthy migrant hypothesis, overall. In addition, the current study explains the healthy migrant hypothesis through self-selection and immigration policy. However, given the findings of this study and previous studies, we speculated that the healthy migrant effect gradually disappears, especially considering the increasing trends of obesity among Asian migrant men and women in Korea.

In conclusion, although most Asian migrants were less likely to have T2D and hypertension than Koreans, primary and secondary prevention of T2D and hypertension among the majority of Asian migrants in Korea, especially targeting specific age and sex groups according to nationality, is required. In addition, the problem of obesity among Asian migrants in Korea, especially in Asian migrant women, should be addressed. The association between Asian migrants and cardiovascular risk factors according to nationality can provide basic evidence for targeting high-risk groups and improving policy development in Korea. Further studies are needed to compare age- and sex-specific differences between migrants and the native population more comprehensively and systematically through mapping health outcomes, healthcare utilisation, and expenses in different areas, according to nationality. Our results could help establish a new strategy to develop an effective and efficient healthcare

system for the prevention, treatment, and management of obesity, diabetes and hypertension among Asian migrants and the native population in Korea.

6 References

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7 Supplementary materials

Table A1. Age-specific prevalence effect of lifestyle factors and socioeconomic estimates among Chinese migrant and Korean men aged 20-49 years who received health check-ups in 2015

Variable	Age-adjusted prevalence*		Prevalence ratio	95% Lognormal Confidence Interval	
	Chinese migrant	Korean	Chinese migrant versus Korean	Lower limit	Upper limit
Men					
Current smoker					
20-29 years	60.7	46.5	1.3	1.2	1.4
30-39 years	61.6	47.6	1.3	1.3	1.3
40-49 years	54.2	45.1	1.2	1.2	1.2
Any alcohol use					
20-29 years	65.9	77.0	0.9	0.8	0.9
30-39 years	72.6	76.6	0.9	0.9	1.0
40-49 years	74.0	74.1	1.0	1.0	1.0
Physical inactivity					
20-29 years	42.6	18.7	2.3	2.1	2.4

30-39 years	44.7	24.0	1.9	1.8	1.9
40-49 years	50.7	27.3	1.9	1.8	1.9
Low income level					
20-29 years	23.5	13.0	1.8	1.7	1.9
30-39 years	15.3	4.5	3.4	3.1	3.6
40-49 years	16.5	8.5	1.9	1.8	2.1
Obesity					
20-29 years	31.9	37.5	0.9	0.8	0.9
30-39 years	38.4	46.9	0.8	0.8	0.8
40-49 years	38.2	45.8	0.8	0.8	0.9
Hypertension					
20-29 years	5.0	6.1	0.8	0.7	0.9
30-39 years	9.6	11.2	0.9	0.8	0.9
40-49 years	21.0	21.1	1.0	1.0	1.0
Diabetes					
20-29 years	1.6	1.4	1.1	0.9	1.4
30-39 years	4.1	3.5	1.2	1.1	1.3
40-49 years	8.3	9.0	0.9	0.9	1.0
Hypercholesterolemia					

20–29 years	4.4	5.4	0.8	0.7	0.9
30–39 years	7.4	11.8	0.6	0.6	0.7
40–49 years	9.4	14.9	0.6	0.6	0.7

* Data are expressed as %.

Table A2. Age-specific prevalence effect of health status among Chinese migrant and Korean women aged 20–49 years who received health check-ups in 2015

Variable	Age-adjusted prevalence*		Prevalence ratio	95% Lognormal Confidence Interval	
	Chinese migrant	Korean	Chinese migrant versus Korean	Lower limit	Upper limit
Women					
Current smoker					
20–29 years	4.7	6.3	0.7	0.6	0.9
30–39 years	4.4	4.1	1.1	0.9	1.2
40–49 years	2.3	3.6	0.6	0.6	0.7
Any alcohol use					
20–29 years	37.1	59.7	0.6	0.6	0.7
30–39 years	32.3	47.0	0.7	0.7	0.7
40–49 years	22.0	37.6	0.6	0.6	0.6
Physical inactivity					

20–29 years	40.3	25.4	1.6	1.5	1.7
30–39 years	47.1	33.4	1.4	1.4	1.5
40–49 years	51.7	32.6	1.6	1.5	1.6
Low income level					
20–29 years	34.1	16.7	2.0	1.9	2.2
30–39 years	28.0	15.6	1.8	1.7	1.9
40–49 years	28.6	22.1	1.3	1.2	1.3
Obesity					
20–29 years	12.8	12.0	1.1	1.0	1.2
30–39 years	22.3	16.6	1.3	1.3	1.4
40–49 years	27.5	23.5	1.2	1.1	1.2
Hypertension					
20–29 years	1.2	1.3	1.0	0.7	1.3
30–39 years	2.8	2.8	1.0	0.8	1.2
40–49 years	10.7	9.7	1.1	1.0	1.2
Diabetes					
20–29 years	0.6	0.7	0.8	0.5	1.2
30–39 years	1.6	1.5	1.0	0.8	1.3
40–49 years	3.2	3.4	0.9	0.9	1.1
Hypercholesterolemia					

20–29 years	2.0	3.1	0.7	0.5	0.8
30–39 years	3.7	6.0	0.6	0.5	0.7
40–49 years	8.0	8.8	0.9	0.8	1.0

* Data are expressed as %.

Table A3. Age-specific prevalence effect of lifestyle factors and socioeconomic estimates among Filipino migrant and Korean men aged 20–49 years who received health check-ups in 2015

Variable	Age-adjusted prevalence*		Prevalence ratio	95% Lognormal Confidence Interval	
	Korean	Filipino migrant	Korean versus Filipino migrant	Lower limit	Upper limit
Men					
Current smoker					
20–29 years	46.5	27.7	1.7	1.6	1.8
30–39 years	47.6	23.0	2.1	2.0	2.2
40–49 years	45.1	18.0	2.5	2.1	3.1
Any alcohol use					
20–29 years	77.0	55.0	1.4	1.3	1.5
30–39 years	76.6	54.5	1.4	1.4	1.5
40–49 years	74.1	50.5	1.5	1.3	1.6

Physical inactivity					
20–29 years	18.7	51.3	0.4	0.3	0.4
30–39 years	24.0	48.7	0.5	0.5	0.5
40–49 years	27.3	44.0	0.6	0.5	0.7
Low income level					
20–29 years	13.0	41.9	0.3	0.3	0.3
30–39 years	4.5	29.0	0.2	0.1	0.2
40–49 years	8.5	14.3	0.6	0.5	0.7
Obesity					
20–29 years	37.5	29.0	1.3	1.2	1.4
30–39 years	46.9	43.1	1.1	1.0	1.1
40–49 years	45.8	50.5	0.9	0.8	1.0
Hypertension					
20–29 years	6.1	5.8	1.1	0.9	1.2
30–39 years	11.2	8.8	1.3	1.2	1.4
40–49 years	21.1	16.9	1.3	1.0	1.5
Diabetes					
20–29 years	1.4	1.3	1.1	0.8	1.5
30–39 years	3.5	3.9	0.9	0.8	1.0

40–49 years	9.0	7.0	1.3	0.9	1.7
Hypercholesterolemia					
20–29 years	5.4	7.4	0.7	0.6	0.8
30–39 years	11.8	12.7	0.9	0.9	1.0
40–49 years	14.9	15.8	0.9	0.8	1.2

* Data are expressed as %.

Table A4. Age-specific prevalence effect of health status among Filipino migrant and Korean women aged 20–49 years who received health check-ups in 2015

Variable	Age-adjusted prevalence*		Prevalence ratio	95% Lognormal Confidence Interval	
	Korean	Filipino migrant	Korean versus Filipino migrant	Lower limit	Upper limit
Women					
Current smoker					
20–29 years	6.3	3.3	1.9	1.3	2.8
30–39 years	4.1	1.5	2.7	1.7	4.4
40–49 years	3.6	1.3	2.8	1.0	7.4
Any alcohol use					
20–29 years	59.7	19.0	3.1	2.7	3.7
30–39 years	47.0	11.6	4.0	3.4	4.8

40–49 years	37.6	9.1	4.1	2.9	6.0
Physical inactivity					
20–29 years	25.4	59.1	0.4	0.4	0.5
30–39 years	33.4	53.2	0.6	0.6	0.7
40–49 years	32.6	45.6	0.7	0.6	0.8
Low income level					
20–29 years	16.7	55.1	0.3	0.3	0.3
30–39 years	15.6	41.0	0.4	0.3	0.4
40–49 years	22.1	43.4	0.5	0.4	0.6
Obesity					
20–29 years	12.0	14.8	0.8	0.7	1.0
30–39 years	16.6	24.2	0.7	0.6	0.8
40–49 years	23.5	41.4	0.6	0.5	0.7
Hypertension					
20–29 years	1.3	1.1	1.1	0.6	2.2
30–39 years	2.8	4.8	0.6	0.4	0.8
40–49 years	9.7	19.4	0.5	0.4	0.6
Diabetes					
20–29 years	0.7	1.2	0.6	0.3	1.1

30–39 years	1.5	3.1	0.5	0.3	0.7
40–49 years	3.4	3.9	0.9	0.5	1.6
Hypercholesterolemia					
20–29 years	3.1	2.2	1.4	0.9	2.3
30–39 years	6.0	4.3	1.4	1.0	1.8
40–49 years	8.8	14.6	0.6	0.5	0.8

* Data are expressed as %.

Table A5. Age-specific prevalence effect of lifestyle factors and socioeconomic estimates among Vietnamese migrant and Korean men aged 20–49 years who received health check-ups in 2015

Variable	Age-adjusted prevalence*		Prevalence ratio	95% Lognormal Confidence Interval	
	Korean	Vietnamese	Korean versus Vietnamese migrant	Lower limit	Upper limit
Men					
Current smoker					
20–29 years	46.5	27.5	1.7	1.6	1.8
30–39 years	47.6	27.9	1.7	1.6	1.8
40–49 years	45.1	35.3	1.3	1.1	1.5
Any alcohol use					

20–29 years	77.0	53.5	1.4	1.4	1.5
30–39 years	76.6	53.3	1.4	1.4	1.5
40–49 years	74.1	51.2	1.4	1.3	1.7
Physical inactivity					
20–29 years	18.7	48.5	0.4	0.4	0.4
30–39 years	24.0	48.4	0.5	0.5	0.5
40–49 years	27.3	51.8	0.5	0.5	0.6
Low income level					
20–29 years	13.0	21.9	0.6	0.6	0.6
30–39 years	4.5	19.0	0.2	0.2	0.3
40–49 years	8.5	17.5	0.5	0.4	0.6
Obesity					
20–29 years	37.5	7.6	4.9	4.5	5.3
30–39 years	46.9	14.3	3.3	3.0	3.6
40–49 years	45.8	21.9	2.1	1.7	2.6
Hypertension					
20–29 years	6.1	2.5	2.4	2.0	2.8
30–39 years	11.2	3.3	3.4	2.9	4.0
40–49 years	21.1	10.4	2.0	1.5	2.8

Diabetes					
20-29 years	1.4	1.0	1.4	1.1	1.8
30-39 years	3.5	2.9	1.2	1.0	1.4
40-49 years	9.0	4.7	1.9	1.2	3.1
Hypercholesterolemia					
20-29 years	5.4	4.1	1.3	1.1	1.5
30-39 years	11.8	8.3	1.4	1.3	1.6
40-49 years	14.9	16.7	0.9	0.7	1.2

* Data are expressed as %.

Table A6. Age-specific prevalence effect of health status among Vietnamese migrant and Korean women aged 20-49 years who received health check-ups in 2015

Variable	Age-adjusted prevalence*		Prevalence ratio	95% Lognormal Confidence Interval	
	Korean	Vietnamese	Korean versus Vietnamese migrant	Lower limit	Upper limit
Women					
Current smoker					
20-29 years	6.3	3.1	2.1	1.1	4.0
30-39 years	4.1	3.4	1.2	0.5	2.9
40-49 years	3.6	0.8	4.4	1.8	10.6

Any alcohol use					
20–29 years	59.7	9.4	6.3	5.6	7.2
30–39 years	47.0	7.1	6.6	5.5	8.1
40–49 years	37.6	2.3	16.5	9.8	27.9
Physical inactivity					
20–29 years	25.4	57.0	0.4	0.4	0.5
30–39 years	33.4	54.8	0.6	0.6	0.7
40–49 years	32.6	54.3	0.6	0.5	0.7
Low income level					
20–29 years	16.7	46.2	0.4	0.3	0.4
30–39 years	15.6	48.2	0.3	0.3	0.4
40–49 years	22.1	34.5	0.6	0.6	0.7
Obesity					
20–29 years	12.0	4.4	2.7	2.3	3.3
30–39 years	16.6	8.6	1.9	1.6	2.3
40–49 years	23.5	15.6	1.5	1.2	1.8
Hypertension					
20–29 years	1.3	0.6	2.1	1.3	3.4
30–39 years	2.8	0.7	3.7	2.1	6.8

40-49 years	9.7	8.6	1.1	0.9	1.5
Diabetes					
20-29 years	0.7	0.5	1.4	0.8	2.4
30-39 years	1.5	1.3	1.2	0.7	1.9
40-49 years	3.4	3.3	1.0	0.7	1.6
Hypercholesterolemia					
20-29 years	3.1	2.3	1.4	1.0	1.8
30-39 years	6.0	3.4	1.7	1.3	2.3
40-49 years	8.8	11.4	0.8	0.6	1.0

* Data are expressed as %.

Table A7. Age-specific prevalence effect of lifestyle factors and socioeconomic estimates among other Asian migrant and Korean men aged 20-49 years who received health check-ups in 2015

Variable	Age-adjusted prevalence*		Prevalence ratio	95% Lognormal Confidence Interval	
	Korean	Other Asian migrant	Korean versus other Asian migrant	Lower limit	Upper limit
Men					
Current smoker					
20-29 years	46.5	33.2	1.4	1.4	1.5
30-39 years	47.6	32.7	1.5	1.4	1.5
40-49 years	45.1	32.0	1.4	1.3	1.5
Any alcohol use	46.5	33.2	1.4	1.4	1.5
20-29 years					
30-39 years	77.0	38.1	2.0	2.0	2.1
40-49 years	76.6	41.2	1.9	1.8	1.9
Physical inactivity	74.1	43.6	1.7	1.6	1.8
20-29 years					
30-39 years	18.7	54.0	0.3	0.3	0.4
40-49 years	24.0	55.1	0.4	0.4	0.4

Low income level	27.3	54.2	0.5	0.5	0.5
20-29 years					
30-39 years	13.0	31.0	0.4	0.4	0.4
40-49 years	4.5	23.5	0.2	0.2	0.2
Obesity					
20-29 years	37.5	21.1	1.8	1.7	1.8
30-39 years	46.9	33.6	1.4	1.4	1.4
40-49 years	45.8	41.7	1.1	1.0	1.2
Hypertension					
20-29 years	6.1	3.1	1.9	1.7	2.1
30-39 years	11.2	5.6	2.0	1.9	2.1
40-49 years	21.1	12.3	1.7	1.6	1.9
Diabetes					
20-29 years	1.4	1.2	1.2	1.0	1.5
30-39 years	3.5	3.0	1.2	1.1	1.3
40-49 years	9.0	6.8	1.3	1.2	1.5
Hypercholesterolemia					
20-29 years	5.4	4.8	1.1	1.0	1.2
30-39 years	11.8	10.7	1.1	1.0	1.2

40-49 years	14.9	14.3	1.0	1.0	1.2

* Data are expressed as %.

Table A8. Age-specific prevalence effect of health status among other Asian migrant and Korean women aged 20-49 years who received health check-ups in 2015

Variable	Age-adjusted prevalence*		Prevalence ratio	95% Lognormal Confidence Interval	
	Korean	Other Asian migrant	Korean versus other Asian migrant	Lower limit	Upper limit
Women					
Current smoker					
20-29 years	6.3	2.8	2.3	1.7	3.0
30-39 years	4.1	5.5	0.7	0.6	0.9
40-49 years	3.6	8.0	0.4	0.3	0.6
Any alcohol use					
20-29 years	59.7	10.9	5.5	4.7	6.3
30-39 years	47.0	16.9	2.8	2.5	3.1
40-49 years	37.6	16.2	2.3	1.9	2.8
Physical inactivity					
20-29 years	25.4	60.3	0.4	0.4	0.5

30-39 years	33.4	55.0	0.6	0.6	0.6
40-49 years	32.6	49.9	0.7	0.6	0.7
Low income level					
20-29 years	16.7	42.9	0.4	0.4	0.4
30-39 years	15.6	36.3	0.4	0.4	0.5
40-49 years	22.1	34.5	0.6	0.6	0.7
Obesity					
20-29 years	12.0	12.1	1.0	0.9	1.1
30-39 years	16.6	23.8	0.7	0.6	0.8
40-49 years	23.5	40.7	0.6	0.5	0.6
Hypertension					
20-29 years	1.3	0.7	1.9	1.0	3.4
30-39 years	2.8	2.9	0.9	0.7	1.3
40-49 years	9.7	11.2	0.9	0.7	1.1
Diabetes					
20-29 years	0.7	0.7	1.1	0.6	1.9
30-39 years	1.5	1.0	1.6	1.0	2.5
40-49 years	3.4	3.6	0.9	0.7	1.4
Hypercholesterolemia					
20-29 years	3.1	3.8	0.8	0.6	1.1

30-39 years	6.0	5.5	1.1	0.9	1.3
40-49 years	8.8	10.0	0.9	0.7	1.1

* Data are expressed as %.

Table A9. Age-specific prevalence effect of raised fasting blood glucose, and raised blood pressure estimates among Chinese migrants and Koreans aged 20-49 years who received health check-ups in 2015

Variable	Age-adjusted prevalence*		Prevalence ratio	95% Lognormal Confidence Interval	
	Chinese migrant	Korean	Chinese migrant versus Korean	Lower limit	Upper limit
Men					
Raised fasting blood glucose					
20-29 years	1.5	1.3	1.1	0.8	1.4
30-39 years	3.8	3.2	1.2	1.1	1.3
40-49 years	7.3	7.7	1.0	0.9	1.0
Raised blood pressure					
20-29 years	4.5	5.3	0.9	0.7	1.0
30-39 years	8.1	9.3	0.9	0.8	0.9
40-49 years	15.8	13.9	1.1	1.1	1.2
Women					

Raised fasting blood glucose					
20–29 years	0.5	0.6	0.8	0.5	1.3
30–39 years	1.3	1.3	1.0	0.8	1.3
40–49 years	2.5	2.8	0.9	0.8	1.0
Raised blood pressure					
20–29 years	1.1	1.1	1.0	0.7	1.4
30–39 years	2.1	2.3	0.9	0.7	1.1
40–49 years	6.8	6.2	1.1	1.0	1.2

* Data are expressed as %; raised fasting blood glucose was defined as fasting blood glucose ≥ 126 mg/dL; raised blood pressure was defined as blood pressure ≥ 140/90 mm Hg.

Table A10. Age–specific prevalence effect of raised fasting blood glucose, and raised blood pressure estimates among Filipino migrants and Koreans aged 20–49 years who received health check–up in 2015

Variable	Age–adjusted prevalence*		Prevalence ratio	95% Lognormal Confidence Interval	
	Korean	Filipino migrant	Korean versus Filipino migrant	Lower limit	Upper limit
Men					
Raised fasting blood glucose					
20–29 years	1.3	1.3	1.0	0.7	1.5

30–39 years	3.2	3.8	0.9	0.7	1.0
40–49 years	7.7	6.5	1.2	0.9	1.6
Raised blood pressure					
20–29 years	5.3	5.4	1.0	0.8	1.2
30–39 years	9.3	8.0	1.2	1.0	1.3
40–49 years	13.9	14.1	1.0	0.8	1.2
Women					
Raised fasting blood glucose					
20–29 years	0.6	1.0	0.6	0.3	1.3
30–39 years	1.3	2.8	0.5	0.3	0.7
40–49 years	2.8	3.2	0.9	0.5	1.6
Raised blood pressure					
20–29 years	1.1	1.0	1.2	0.6	2.4
30–39 years	2.3	3.4	0.7	0.5	1.0
40–49 years	6.2	14.2	0.4	0.3	0.6

* Data are expressed as %; raised fasting blood glucose was defined as fasting blood glucose ≥ 126 mg/dL; raised blood pressure was defined as blood pressure ≥ 140/90 mm Hg.

Table A11. Age-specific prevalence effect of raised fasting blood glucose, and raised blood pressure estimates among Vietnamese migrants and Koreans aged 20-49 years who received health check-up in 2015

Variable	Age-adjusted prevalence*		Prevalence ratio	95% Lognormal Confidence Interval	
	Korean	Vietnamese migrant	Korean versus Vietnamese migrant	Lower limit	Upper limit
Men					
Raised fasting blood glucose					
20-29 years	1.3	1.0	1.4	1.0	1.8
30-39 years	3.2	2.6	1.2	1.0	1.5
40-49 years	7.7	3.8	2.0	1.2	3.4
Raised blood pressure					
20-29 years	5.3	2.3	2.3	2.0	2.7
30-39 years	9.3	2.8	3.3	2.8	4.0
40-49 years	13.9	8.8	1.6	1.1	2.2
Women					
Raised fasting blood glucose					
20-29 years	0.6	0.5	1.2	0.7	2.2
30-39 years	1.3	1.2	1.1	0.7	1.7
40-49 years	2.8	2.4	1.1	0.7	1.9

Raised blood pressure					
20–29 years	1.1	0.5	2.1	1.2	3.5
30–39 years	2.3	0.3	6.9	2.8	16.6
40–49 years	6.2	6.5	0.9	0.7	1.3

* Data are expressed as %; raised fasting blood glucose was defined as fasting blood glucose ≥ 126 mg/dL; raised blood pressure was defined as blood pressure ≥ 140/90 mm Hg.

Table A12. Age–specific prevalence effect of raised fasting blood glucose, and raised blood pressure estimates among other Asian migrants and Koreans aged 20–49 years who received health check–up in 2015

Variable	Age–adjusted prevalence*		Prevalence ratio	95% Lognormal Confidence Interval	
	Korean	Other Asian migrant	Korean versus other Asian migrant	Lower limit	Upper limit
Men					
Raised fasting blood glucose					
20–29 years	1.3	1.2	1.1	0.9	1.4
30–39 years	3.2	2.8	1.2	1.1	1.3
40–49 years	7.7	6.0	1.3	1.1	1.5
Raised blood pressure					
20–29 years	5.3	3.0	1.8	1.6	2.0

30-39 years	9.3	5.0	1.9	1.7	2.0
40-49 years	13.9	10.0	1.4	1.2	1.5
Women					
Raised fasting blood glucose					
20-29 years	0.6	0.7	0.9	0.5	1.7
30-39 years	1.3	0.8	1.5	0.9	2.6
40-49 years	2.8	3.3	0.8	0.6	1.2
Raised blood pressure					
20-29 years	1.1	0.5	2.2	1.1	4.4
30-39 years	2.3	2.1	1.1	0.8	1.5
40-49 years	6.2	8.0	0.8	0.6	1.0

* Data are expressed as %; raised fasting blood glucose was defined as fasting blood glucose ≥ 126 mg/dL; raised blood pressure was defined as blood pressure ≥ 140/90 mm Hg.

8 국문초록

한국에 거주하는 아시아 이주민과 내국인 간 심혈관질환 위험요인의 비교

HENG PIAO

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국제 이주 문제는 사회적 및 공중 보건 영역에서 여러가지 이슈가 되고 있다. 본 연구는 국민 건강보험공단자료를 (2009-2015년) 이용, 건강검진 수검자 20세 이상의 성인 2,680,495명 (아시아 이주민 987,214명, 내국인 1,693,281명)을 분석하였다. 세계표준인구를 표준 인구로 연령표준화 유병율을 산출하였다. 2015년도 연령표준화 비만 유병률은 중국 이주민 여성이 (25.6%) 한국인 여성보다 (23.2%) 높았고 ($P < 0.0001$), 필리핀 이주민 여성이 (30.9%) 한국인 여성보다 높았고 ($P = 0.0023$), 기타 아시아 이주민 여성이 (35.5%) 한국인 여성보다 높았다 ($P < 0.0001$). 20-49세 연령그룹에서 필리핀 이주민 여성의 (2.6%) 연령표준화 당뇨병 유병률은 한국인 여성보다 (1.8%) 높았고 ($P = 0.0090$), 필리핀 이주민 여

성의 (7.7%) 연령표준화 고혈압 유병률은 한국인 여성보다 (4.2%) 높았다 (P < 0.0001). 다중회귀분석에서 한국인에 비하여 아시아 이주민의 당뇨병 (aOR, 0.82; 95% CI, 0.78 – 0.86) 고혈압 (aOR, 0.77; 95% CI, 0.75 – 0.79) 오즈비가 낮게 나타났다. 하지만 20–39세 연령그룹에서 한국인 남성에 비하여 베트남 이주민 남성의 당뇨병 (aOR, 1.32; 95% CI, 1.11 – 1.57) 오즈비는 높게 나타났고, 20–39세와 40세 이상 두 연령그룹에서 한국인 여성에 비하여 필리핀 이주민 여성의 고혈압 (aOR, 1.49; 95% CI, 1.05 – 2.11), (aOR, 2.22; 95% CI, 1.17 – 4.19) 오즈비가 각각 더 높게 나타났다. 심혈관질환 위험요인들의 annual percentage change (APC)를 추정하기 위해 Joinpoint 회귀분석을 시행하였다. Joinpoint 회귀분석에서도 연령표준화를 실시하였고, 연령그룹은 20–44, 45–64, ≥ 65세로 구성되었다. 2005년도 한국 연앙인구를 표준 인구로 사용하였다. 내국인 남성에 비하여 아시아 이주민 남성의 연령표준화 비만 유병률은 증가하는 추세로 나타났고 (2009년 27.9%에서 2013년 28.9%, APC = 0.89, P < 0.05; 2013년 28.9%에서 2015년 31.7%, APC = 4.70, P < 0.05); 내국인 여성에 비하여 아시아 이주민 여성의 연령표준화 비만 유병률은 증가하는 추세로 나타났다 (2009년 22.5%에서 2015년 25.2%, APC = 1.92, P < 0.05). 마지막으로 2015년도 필리핀 이주민 남성의 (41.4%) 연령표준화 비만 유병률은 필리핀 남성 일반인구보다 (30.4%) 높았고, 2014년도 필리핀 이주민 남성의 (12.5%) 연령표준화 당뇨병 유병률은 필리핀 남성 일반인구보다 (7.1%) 높았다. 본 연구의 결과들은 아시아 이주민과 한국인 인구의 비만, 당뇨병, 고혈압 예방, 치료 및 관리를 위한 새

로운 전략을 수립하는데 도움이 될 수 있다.

주요어: 비만, 당뇨병, 고혈압, 필리핀 이주민, 베트남 이주민, 국민건강보험공단 데이터

학번: 2013-31353

9 감사의 글

저는 지난 10년 가까이 낯선 한국 땅에서 대학원 석사, 박사과정을 거치며 많은 분들의 큰 도움을 받았습니다. 언제나 따뜻하게 격려해 주시고 지도해주신 조비룡 교수님께 가장 먼저 깊은 감사를 드립니다. 그리고 그 동안 부족한 저를 잘 이끌어 주시고 배려해주신 강대희 교수님께도 깊은 감사의 말씀을 올립니다. 학위논문을 지도해주신 강영호 교수님, 강재헌 교수님, 이종구 교수님께도 깊은 감사를 드립니다. 학위논문은 물론 관련 연구에 각별한 지도와 큰 도움을 주신 신동욱 교수님, 신애선 교수님, 윤재문 교수님, 허종호 교수님께도 깊은 감사를 드립니다. 2011년부터 한국 유학 생활 중 저에게 많은 도움을 주신 강명옥 교수님, 곡우 박사님, 구태근 선생님, 김경우 교수님, 김규웅 선생님, 김미경 교수님, 김상혁 교수님, 김수정 박사님, 김소연 교수님, 김정은 교수님, 남은우 교수님, 노민수 교수님, 량해성 박사님, 박민희 선생님, 박병주 교수님, 박상민 교수님, 박원철 교수님, 박윤성 박사님, 박정규 교수님, 장은화 교수님, 손기영 교수님, 신우경 박사님, 안아름 교수님, 양귀복 박사님, 오범조 교수님, 이경희 교수님, 이연주 선생님, 이임선 교수님, 이주연 선생님, 이재호 교수님, 이혜진 교수님, 이휘원 박사님, 임상미 선생님, 임광 선생님, 장은화 교수님, 정선재 교수님, 정원주 선생님, 주정정 박사님, 최민호 교수님, 최지엽 교수님, 최진욱 교수님, 한경도 교수님들의 따뜻한 배려에 감사드립니다. 마지막으로 항상 저를 믿고 묵묵히 지지하고 지켜봐 주시는 박청룡 큰 아버님과 부모님께도 감사

를 드립니다.